

Honeywell Bull

TIME-SHARING
APPLICATIONS LIBRARY GUIDE
VOLUME IV —
BUSINESS & FINANCE

SERIES 600/6000

APPLICATIONS



Honeywell Bull

TIME-SHARING APPLICATIONS LIBRARY GUIDE VOLUME IV — BUSINESS & FINANCE

SERIES 600/6000

SUBJECT:

Descriptions of Business and Finance Time-Sharing Programs.

SPECIAL INSTRUCTIONS:

This manual, Order Number DA46, Revision 1, supersedes the previous edition, Revision 0, dated December 1972. Change bars in the margins indicate technical changes and additions to this edition.

This is the fourth volume to the Time-Sharing Applications Library Guide. The three related manuals include Series 600/6000 Time-Sharing Applications Library Guide, Volume I - Mathematics (Order No. DA43), Volume II-Statistics (Order No. DA44), and Volume III-Industry (Order No. DA45). A complete printing of the programs in the library is available by listing the library program, CATALOG. A copy of this listing follows the Contents.

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PREFACE

This manual describes and discusses the usage of the business and finance time sharing programs available with Series 600 and 6000 information processing systems. The programs are listed alphabetically in the Contents.

Each program description includes the purpose of the program; language in which it is written; method of approach, if applicable; instructions for use; and sample problems and solutions. In the sample solutions, all information typed by the user is underlined. However, in some programs, instead of the user typing in data, a sample driver program is coded to solve the particular problem. These programs solved by driver programs show *LIST or *RUN at the head of the printout.

The instructions provided assume that the programs are available in the user master catalog, LIBRARY, and accessible with read or execute permission. In the sample solution printouts, the programs have already been accessed using the GET command, and/or copied onto the current file using the OLD or LIB command.

A complete printing of the programs in the library is available by listing the library program, CATALOG. A copy of this listing follows the Contents.

Other Series 600/6000 Time-Sharing Library programs are described in the following documents:

Series 600/6000 Time-Sharing Applications Library Guide

Volume I - Mathematics, Order Number DA43

Volume II - Statistics, Order Number DA44

Volume III - Industry, Order Number DA45

This document describes programs that originated from a variety of sources, such as users and the Honeywell field organization. The programs are made available in the general form and degree of completeness in which they were received. Honeywell Information Systems Inc., therefore, neither guarantees the accuracy of the programs nor assumes support responsibility.

The programs listed below have been incorporated in this edition. In addition to MGSIM (MGSIM-IN), which was revised, the following new programs have been added.

ACCRUIT
BALANCE
INTRSTZ
NOM-EFF
RISKIT
SIMFUND
VALSTK

Series 600/6000 Time-Sharing Applications Library programs are also available to users of the DATANETWORK service. Please contact your local Honeywell representative for further details.

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BONDATA	Analyzes Bond Investment Portfolio	BF-17
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MAKE-BUY	Calculating Whether to Buy or Make Manufacturing Components	BF-71
MGSIM	Management Simulation	BF-75
MORTCST	Quick Comparison of Different Mortgage Terms	BF-87
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SAVING	Calculates Value of a Savings Plan at Compound Interest.....	BF-113
SIMFUND	Simulates the Future Performance of an Investment Fund	BF-115
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VALSTK	Calculates the Intrinsic Value of Stock	BF-127

CATALOG OF SERIES 6000/600 T-S LIBRARY PROGRAMS

FILE TYPE INDICATOR:

LANGUAGE (FIRST LETTER)	MODE (FOLLOWING LETTERS)
A ALGOL	P (OR BLANK) PROGRAM
B BASIC	S SUBROUTINE(S)
C CARDIN	F FUNCTION(S)
D DATABASIC	P-S PROGRAM WITH EXTRACTABLE SUBROUTINE(S)
E TEXT EDITOR	R RELOCATABLE OBJECT (C*)
F FORTRAN	H SYSTEM LOADABLE OBJECT (H*)
G GMAP	L USER'S RANDOM LIBRARY

ALL FILES ARE SOURCE MODE UNLESS OTHERWISE INDICATED.

SUBJECTS

DOCUMENTATION MANUAL

MATHEMATICS (MA)ORDER # DA43

INTEGRATION
DIFFERENTIATION, DIFFERENTIAL EQ.
INTERPOLATION
POLYNOMIALS
LINEAR EQUATIONS
MATRICES
NON-LINEAR EQUATIONS
SPECIAL FUNCTION EVALUATION
LOGIC AND NUMBER THEORY

STATISTICS (ST)ORDER # DA44

CURVE FITTING AND REGRESSION
ANALYSIS OF VARIANCE
PROBABILITY DISTRIBUTIONS
CONFIDENCE LIMITS
HYPOTHESIS TESTING
DESCRIPTIVE STATISTICS
RANDOM NUMBER GENERATION
MISCELLANEOUS STATISTICS

MANAGEMENT SCIENCE AND OPTIMIZATION (MS)ORDER # DA45

LINEAR PROGRAMMING
INTEGER PROGRAMING
NON-LINEAR OPTIMIZATION
NETWORK ANALYSIS
FORECASTING
SIMULATION

ENGINEERING (EN)

GEOMETRIC AND PLOTTING (GP)

EDUCATION AND TUTORIAL (ED)

DEMONSTRATION (DE)

UTILITY AND MISCELLANEOUS (UM)

BUSINESS AND FINANCE (BF)ORDER # DA46

THE DOCUMENTATION FOR THESE PROGRAMS IS AVAILABLE IN FOUR MANUALS:

SEE ORDER # DA43 FOR PROGRAMS IN MATHEMATICS

ORDER # DA44 FOR PROGRAMS IN STATISTICS

ORDER # DA46 FOR PROGRAMS IN BUSINESS AND FINANCE

ORDER # DA45 FOR PROGRAMS IN ALL OTHER CATEGORIES.

SUBROUTINES THAT ARE CALLED BY A PROGRAM AND MUST BE EXECUTED WITH IT ARE LISTED IN BRACKETS AT THE END OF THE DESCRIPTION.

THESE PROGRAMS HAVE ALL BEEN REVIEWED AND TESTED BUT NO RESPONSIBILITY CAN BE ASSUMED.

*****MA--MATHEMATICS*****

INTEGRATION

CLCINT	FF	INTEGRATION BY SIMPSON'S RULE
FINT	FF	EVALUATE FOURIER INTEGRALS BY FILON'S FORMULA
GAHER	FF	GAUSS-HERMITE QUADRATURE
GALA	FF	GAUSS-LAGUERRE QUADRATURE
GAUSSN	FF	EVALUATE DEFINITE DOUBLE OR TRIPLE INTEGRALS
GAUSSQ	FF	GAUSSIAN QUADRATURE
NC0ATES	FP-S	NEWTON-C0ATES QUADRATURE
NUMINT	B	GAUSSIAN QUADRATURE
R0MBINT	FP-S	R0MBERG INTEGRATION
SPLINE	B	INTEGRATE TABULATED FUNCTION BY SPLINE FITS

DIFFERENTIATION, DIFFERENTIAL EQ.

AMPBX	FS	ADAMS-M0ULTON FOR 1ST-ORDER DIFF. EQNS (RKPBX)
FDRVUL	FF	DIFFERENTIATE TABULATED FUNCTION, UNEQUAL SPACING
HDRVEB	FF	DIFFERENTIATE TABULATED FUNCTION, EQUAL SPACING
RKPBX	FS	RUNGE-KUTTA FOR 1ST-ORDER DIFF. EQNS

***INTERPOLATION*

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SPLINT	B	SPLINE INTERPOLATION
TNT1	FF	SINGLE LAGRANGIAN INTERPOLATION (TLU1)
TNT2	FF	DOUBLE LAGRANGIAN INTERPOLATION (TLU1)
TNT2A	FF	VARIABLE DOUBLE LINEAR INTERPOLATION (TLU1)

POLYNOMIALS

BIC0F	FS	CALCULATE BINOMIAL COEFFICIENTS
CLPLY	FF	EVALUATE REAL POLY AT REAL ARGUMENT
CP0LY	FS	FINDS ZEROES OF A COMPLEX POLYNOMIAL
CP0LY-DR	FP	FINDS ZEROES OF A COMPLEX POLYNOMIAL (CP0LY)
DVALG	FS	POLYNOMIAL DIVISION
EUALG	FS	G.C.D. OF TWO POLYNOMIALS (DVALG)
MTALG	FS	MULTIPLY POLYNOMIALS
PLMLT	FS	REAL POLY COEFFICIENTS RECONSTRUCTED FROM REAL ROOTS
P0LRTS	FP	SOLUTION OF POLY BY BAIRSTOWS METHOD
P0LYC	FS	REAL POLY COEFFICIENTS RECONSTRUCTED FROM COMPLEX ROOTS
P0LYV	FS	EVALUATE REAL POLY AT COMPLEX ARGUMENT
QUADEQ	B	SOLUTION TO QUADRATIC EQUATIONS
R00TER	B	SOLUTION OF POLY BY BAIRSTOWS METHOD
ZC0P	FP	ROOTS OF POLYNOMIAL WITH COMPLEX COEFF.
ZC0P2	FS	ROOTS OF POLYNOMIAL WITH COMPLEX COEF. (ZC0P2)
Z0RP	FP	ROOTS OF REAL POLY
Z0RP2	FS	ROOTS OF REAL POLY

LINEAR EQUATIONS

GJSIMEQ	FS	SOLVE LINEAR SYSTEMS BY GAUSS-JORDAN
GSEIDEL	FP-S	SOLVE LINEAR SYSTEMS BY GAUSS-SEIDEL
LINEQ	FS	SOLVE LINEAR SYSTEMS BY GAUSSIAN ELIMINATION
LINSR	FP	SOLVE LINEAR SYSTEMS BY GAUSSIAN ELIMINATION (LINEQ)
SIMEQN	B	SOLVE LINEAR SYSTEMS BY MATRIX INVERSION

MATRICES

DETE	FF	EVALUATE DETERMINANT OF REAL MATRIX
D0MEIG	FP-S	DOMINANT EIGENVALUES OF REAL MATRIX
EIG1	FS	EIGENVALUES OF SYM MATRIX BY JACOBI METHOD
EIGNHC	FS	EIGENVALUES & VECTORS OF COMPLEX NON-HERMITIAN MATRICES
EIGNSR	FS	EIGENVALUES & VECTORS OF REAL NON-SYMMETRIC MATRICES
EIGSR	FP	EIGENVALUES AND VECTORS OF REAL SYM. MATRIX (EIG1)
LINSO	FS	SOLVE LIN. SYS. W/ SYMMETRIC DOUBLE PREC. COEF. MATRIX
LINSS	FS	SOLVE LIN. SYS. W/ SYMMETRIC SINGLE PREC. COEF. MATRIX
MTINV	FS	MATRIX INVERSION BY PIVOTS
MTMPY	FS	MATRIX MULTIPLICATION
MTRAN	FS	TRANPOSE A MATRIX
SPEIG1	FS	SPECIAL EIGEN PROBLEMS (EIG1)
SYMEIG	FP	EIGENVALUES OF SYM MATRIX BY JACOBI METHOD

NON-LINEAR EQUATIONS

BROWN	FS	SOLN OF SIMULTANEOUS SYSTEMS BY BROWN METHOD
SECANT	FS	SOLN OF SIMULTANEOUS SYSTEMS BY SECANT METHOD (MTINV)
SOLN	FF	ZERO OF AN ARBITRARY FUNCTION
ZEROES	B	ZERO, MAX, MIN OF FUNCTION

SPECIAL FUNCTION EVALUATION

ARCTAN	FF	ARCTANGENT IN RADIANS OF Y/X
BESL	FS	BESSEL FUNCTION (GAMF)
COMP1	FF	EVALUATES REAL HYPERBOLIC TRIG FUNCTIONS
COMP2	FS	COMPLEX MULT. AND DIVISION
COMP3	FS	EVALUATES VARIOUS FUNCTIONS FOR COMPLEX ARGUMENT (COMP2)
ERRF	FF	ERROR FUNCTION
ERRINV	FF	INVERSE ERROR FUNCTION
FRESNL	FS	EVALUATES FRESNAL INTEGRALS
GAMF	FF	GAMMA FUNCTION
JACELF	FS	EVALUATES JACOBIAN ELLIPTIC FUNCTIONS SN, CN, DN
ORTHF	FF	EVALUATE ORTHOGONAL POLYNOMIALS
STIRLING	FP-S	N FACTORIAL BY STIRLINGS APPROXIMATION
TMFCEV	B	EVALUATE DAMPED OR UNDAMPED FOURIER SERIES

LOGIC AND NUMBER THEORY

4SQRS	B	WRITES INTEGERS AS SUM OF SQUARES OF FOUR INTEGERS
BASE	FP	CONVERTS NUMBERS FROM ONE BASE TO ANOTHER
CONCLUDE	B	DETERMINES LOGICAL CONCLUSIONS FROM PROPOSITIONAL LOGIC
GCDN	FS	G.C.D. OF N INTEGERS

*****ST--STATISTICS*****

CURVE FITTING AND REGRESSION

CFIT	FP	LEAST SQRS. POLY. WITH RESTRAINTS
CURFIT	B	FITS SIX DIFFERENT CURVES BY LEAST SQRS
F0RIR	FP	LEAST SQUARES ESTIMATE OF FINITE FOURIER SERIES MODEL
FOURIER	B	COEFF OF FOURIER SERIES TO APPROX A FUNCTION
LINEFIT	FS	LEAST SQRS LINE
LINREG	B	LST.SQRS. BY LINEAR, EXPONENTIAL, OR POWER FUNCTION
LSPCFP	FP	LEAST SQRS POLYNOMIAL FIT
LSQMM	FS	GENERALIZED POLY FIT BY LEAST SQRS OR MIN-MAX
MREG1	FP	MULTIPLE LINEAR REGRESSION
MULFIT	B	MULTIPLE LINEAR FIT WITH TRANSFORMATIONS
ORPOL	FP	LEAST SQRS FIT WITH ORTHOGONAL POLYS
P0LFIT	B	LEAST SQRS POLYNOMIAL FIT
P0LFT	FP	LEAST SQRS POLYNOMIAL FIT
SHLRP	FP	MULTIPLE LINEAR REGRESSION
STAT20	B	EFFROYMSON'S MULTIPLE LINEAR REGRESSION ALGORITHM
STAT21	B	COMPUTES MULTIPLE LINEAR REGRESSIONS

ANALYSIS OF VARIANCE

ANOVA	FP	ONE OR TWO WAY ANALYSIS OF VARIANCE
ANVA1	FP	ONEWAY ANALYSIS OF VARIANCE
ANVA3	FP	THREE WAY ANALYSIS OF VARIANCE
ANVAS	FP	MULTIPLE VARIANCE ANALYSIS
KRUWAL	FP	KRUSKAL-WALLIS 2-WAY VARIANCE (XINGAM)
ONEWAY	B	ONEWAY ANALYSIS OF VARIANCE
STAT13	B	ANALYSIS OF VARIANCE TABLE, 1-WAY RANDOM DESIGN
STAT14	B	ANALYSIS OF VARIANCE TABLE FOR RANDOMIZED BLOCK DESIGN
STAT15	B	ANALYSIS OF VARIANCE TABLE FOR SIMPLE LATIN-SQ DESIGN
STAT16	B	ANALYSIS OF VARIANCE TABLE, GRAECO-LATIN SQUARE DESIGN
STAT17	B	ANOVA TABLE OF BALANCED INCOMPLETE BLOCK DESIGN
STAT18	B	ANALYSIS OF VARIANCE TABLE, YODEN SQUARE DESIGN
STAT33	B	ANALYSIS OF VARIANCE TABLE, 1-WAY RANDOM DESIGN

PROBABILITY DISTRIBUTIONS

ANPF	FF	NORMAL PROBABILITY FUNCTION [ERRF]
BETA	FF	BETA DISTRIBUTION
BINDIS	B	BINOMIAL PROBABILITIES
EXPLIM	B	EXPONENTIAL DISTRIBUTIONS
POISON	FF	POISSON DISTRIBUTION FUNCTION
PROBC	FP	PROBABILITIES OF COMBINATIONS OF RANDOM VARIABLES
PROVAR	B	NORMAL AND T-DISTRIBUTION
TDIST	FF	T-DISTRIBUTION [BETA]
XINGAM	FF	INCOMPLETE GAMA FUNCTION

CONFIDENCE LIMITS

BAYES	B	DIFFERENCE OF MEANS IN NON-EQUAL VARIANCE
BICNF	B	CONF. LIMITS FOR POPULATION PROPORTION (BINOMIAL)
BINOM	FP	BINOMIAL PROBABILITIES AND CONFIDENCE BANDS
COLINR	B	CONFIDENCE LIMITS ON LINEAR REGRESSIONS
CONBIN	B	CONF. LIMITS FOR POPULATION PROPORTION (NORMAL)
CONDIF	B	DIFFERENCE OF MEANS IN EQUAL VARIANCE
CONLIM	B	CONF. LIMITS FOR A SAMPLE MEAN
STAT05	B	CONFIDENCE INTERVAL FOR MEAN BY SIGN TEST
STAT06	B	CONFIDENCE LIMITS, WILCOXON SIGNED RANK SUM TEST

***HYPOTHESIS TESTING*

**

BITEST	B	TEST OF BINOMIAL PROPORTIONS
CHISQR	FS	CHI-SQUARE CALCULATIONS
CORREL	FP	CONTINGENCY COEFFICIENT [XINGAM]
CORRL2	FP	CORRELATION COEFFICIENT [TDIST,BETA]
KOKO	FP	KOLMOGOROV-SMIRNOV TWO SAMPLE TEST [XINGAM]
SEVPR0	B	CHI-SQUARE
STAT01	B	MEAN, STD OF MEAN, ... , T-RATIO, 2 GROUPS, PAIRED
STAT02	B	MEANS, VARIANCES, AND T-RATIO 2 GROUPS, UNPAIRED DATA
STAT04	B	CHI-SQUARE AND PROBABILITIES, 2X2 TABLES
STAT08	B	COMPARES TWO GROUPS OF DATA USING THE MEDIAN TEST
STAT09	B	COMPARE 2 DATA GROUPS, MANN-WHITNEY 2-SAMPLE RANK TEST
STAT11	B	SPEARMAN RANK CORRELATION COEF. FOR 2 SERIES OF DATA
STAT12	B	COMPUTES CORRELATION MATRIX FOR N SERIES OF DATA
TAU	FP	KENDALL-RANK CORRELATION

DESCRIPTIVE STATISTICS

MANDSD	B	FIND MEAN, VARIANCE, STD
STAT	FP	FIND SEVERAL STATISTICS FOR SAMPLE DATA [ANPF,ERRF]
STATAN	B	FIND VARIOUS STATISTICAL MEASURES
TESTUD	B	SAMPLE STATISTICS
UNISTA	B	DESCRIPTION OF UNI-VARIANT DATA

RANDOM NUMBER GENERATION

FLAT	GRF	UNIFORM RANDOM NUMBER GENERATOR
FLATS0RC	C	CARDIN SOURCE FILE FOR FLAT
RANDX	FF	RANDOM #'S, UNIFORM DIST. BETWEEN 0 AND 1
RNDNRH	FF	CALCULATES NORMAL RANDOM NUM. [FLAT]
UNIFM	GRF	UNIFORM RANDOM NUMBER GENERATOR
UNIFMS0RC	C	CARDIN SOURCE FILE FOR UNIFM
URAN	GRF	UNIFORM RANDOM NUMBER GENERATOR
URANS0RC	C	CARDIN SOURCE FILE FOR URAN
XN0R1	FF	NORMAL RANDOM NUMBERS, VARIABLE MEAN, STD [RANDX]
XN0RM	FF	NORMAL RANDOM NUMBERS, MEAN 0, STD 1. [RANDX]

MISCELLANEOUS STATISTICS

FACTAN	FP	FACTOR ANALYSIS
STADES		EXPLANATION OF COLINR, CURFIT, MULFIT, UNISTA

*****MS--MANAGEMENT SCIENCE AND OPTIMIZATION*

LINEAR PROGRAMMING

ASIGNIT B THE ASSIGNMENT PROBLEM
LINPRO B LINEAR PROGRAMMING
LNPROG FP LINEAR PROGRAMMING
SIMPLEX B LINEAR PROGRAMMING BY THE SIMPLEX METHOD
TRANSP B THE TRANSPORTATION PROBLEM
UNDEQ FS FINDS A SOLUTION FOR AN UNDERDETERMINED LINEAR SYSTEM

INTEGER PROGRAMMING

INTOI FP ZIGNTS' MODIFICATION OF BALAS' ZERO-ONE ALGORITHM
INTLP FP GOMORY'S PURE AND MIXED INTEGER PROGRAMMING

NON-LINEAR OPTIMIZATION

CSM FS OPTIMIZE A LINEARLY CONSTRAINED CONVEX FUNCTION[UNDEQ]
DAVIDON B DAVIDON'S UNCONSTRAINED OPTIMIZATION
GEOSIM B HEURISTIC SCHEDULING OF N JOBS IN A M MACHINE SHOP
GPRQG FHP SOLVES GEOMETRIC PROGRAMMING PROBLEMS
GPRQG-SO C CARDIN SOURCE FILE FOR GPRQG [UNDEQ;CSM]
JSSIM B SCHEDULES N JOBS IN A SHOP WITH M MACHINES
LAYOUT B OPTIMIZES A PLANT LAYOUT ACCORDING TO VOLLMANN-RUML MODE
LOGIC3 FP UNCONSTRAINED OPTIMIZATION
MAXOPT FP UNCONSTRAINED OPTIMIZATION

NETWORK ANALYSIS

CPM FP CRITICAL PATH METHOD
CPMLOOP FP DETECTS AND LISTS LOOPS IN A CPM NETWORK
KILTER FP 'OUT OF KILTER' ALGORITHM (MINIMUM COST CIRCULATION)
MAXFLOW FP MAXIMUM FLOW THRU NETWORK
PERT B SIMPLE ANALYSIS OF A PERT NETWORK
SHORTEST FP SHORTEST PATH - MIN SPANNING TREE

FORECASTING

COEFS B DETERMINE SEASONAL COEFFICIENTS ON TWO CYCLES
COMBI B DETERMINES ECONOMIC ORDER QUANTITY FOR INVENTORY ITEMS
OPTIM F OPTIMUM SERVICE LEVEL FOR ONE INVENTORY ITEM
SMOOTH FS TRIPLE SMOOTHING OF A TIME SERIES
TCAST FHP TIME SERIES FORECASTING

SIMULATION

GASPDAT E DATA FILE FOR SAMPLE PROGRAM GASPSAMP
GASPIIA FS 'GASP' SIMULATION SYSTEM
GASPSAMP FP SAMPLE PROGRAM FOR GASPIIA [GASPIIA;GASPDAT]

*****EN--ENGINEERING*****

ACNET FP FREQUENCY RESPONSE OF A LINEAR CIRCUIT
BEMDES B STEEL BEAM SELECTION
GCVSIZ B GAS CONTROL VALVE COEFF.
LCVSIC B LIQUID CONTROL VALVE COEFF.
LFILTR B SYNTHESIZES ACTIVE LOW-PASS FILTERS [LFLDAT]
LFLDAT DATA FOR LFILTR
LFLTIN INSTRUCTIONS FOR LFILTR
LPFILT B DESIGN LOW PASS FILTERS
NLNET FP GENERAL STEADY-STATE CIRCUIT ANALYSIS
OTTO B OTTO CYCLE OF ENGINE
PAVEIT B CALCULATES \$ COST AND TONS OF MATERIAL TO PAVE A ROAD
PVT FP FINDS MOLAR VOLUME OF A GAS GIVEN TEMPERATURE AND PRES.
SCVSIZ B STEAM CONTROL VALVE COEFF.
SECAP B STEEL SECTION CAPACITIES

*****GP-GEOMETRIC AND PLOTTING*****

CIRCLE	B	DIVIDES A CIRCLE INTO N EQUAL PARTS
PLOT	FS	PLOTS UP TO 9 CURVES SIMULTANEOUSLY
PLOTT0	B	SIMULTANEOUSLY PLOTS 1 TO 6 FUNCTIONS
PLOT1	FS	PLOTS UP TO 9 CURVES SIMULTANEOUSLY
P0LPLO	FP	PLOTS EQNS IN POLAR COORDINATES
SPHERE	B	SOLVES ANY SPHERICAL TRIANGLE
TRIANG	B	SOLVES FOR ALL PARTS OF ANY TRIANGLE
TW0PLO	B	SIMULTANEOUSLY PLOTS 2 FUNCTIONS
XYPLOT	B	PLOTS SINGLE-VALUED FUNCTIONS

*****ED--EDUCATION AND TUTORIAL*****

DRIVES	FHP	DRIVER FOR EXPR, A COMPUTER ASSISTED INST. LANG.
EXPERN	E	EXPR TUTORIALS IN EXPR (N=1 TO 5) [PREPRS,DRIVES]
PREPRS	FHP	PREPROCESSOR FOR EXPR, A COMPUTER ASSISTED INST. LANG.

**

*****DE--DEMONSTRATION*****

AMAZE	B	CONSTRUCTS MAZES - EACH UNIQUE
BLKJAK	B	THE COMPUTER DEALS BLACKJACK
M00NER	B	SIMULATES A LUNAR LANDING(M00NER1,M00NER2)
M00NER1		DATA FILE FOR FOR M00NER
M00NER2		INSTRUCTIONS FILE FOR M00NER
P0PING	B	POPULATION PROJECTIONS FOR AN AREA
PRIME	B	PRIME FACTORIZATION OF A NUMBER
XMAS	B	A HOLIDAY SING-ALONG, CHRISTMAS CARD AND GREETINGS

*****UM--UTILITY AND MISCELLANEOUS*****

ADATER	FP-S	A CALENDER DATING ROUTINE
ACCESS	GS	GMAP SUBROUTINE TO USE T/S ACCESS SYSTEM (APPLIB
APARAM	GS	GMAP SUBROUTINE TO DETERMINE T/S OR BATCH MODE (APPLIB
APPLIB	GL	USERS LIBRARY OF FORTRAN CALLABLE GMAP ROUTINES (APPLIB-R
ASCB0D	GS	GMAP SUBROUTINE TO CONVERT ASCII TO BCD (APPLIB
BCDASC	GS	GMAP SUBROUTINE TO CONVERT BCD TO ASCII (APPLIB
CALLSS	GS	GMAP SUBROUTINE TO CALL A T/S SUBSYSTEM (APPLIB
CATALOG	E	CATALOG OF SERIES 6000/600 T/S LIBRARY (THIS FILE)
CONVRT	B	CONVERTS MEASUREMENTS FROM ONE SCALE TO ANOTHER
DBLSORT	FS	SORT TWO ARRAYS
DCS	FS	FORTRAN SUBR. TO TRANSFER CHARACTERS FROM STRING TO STRI
DEFIL	GS	GMAP SUBROUTINE TO CREATE TEMPORARY FILES (APPLIB
DESEQ	FP	STRIPS LINE SEQUENCE NUMBERS FROM A FILE
GMAP	FP	FORTRAN--AN INTERFACE TO GMAP ASSEMBLER (GMAP-S0R)
KIN	GS	GMAP SUBR. TO READ LAST LINE FROM TERM. IN BUFF. (APPLIB
REFORM	FP	REFORMATS A 'NF0RM' FORTRAN SOURCE FILE TO 'F0RM'
RLINE	FS	READS LINE, OPTIONALLY STRIPS LINE # & COUNTS ENTRIES
SGLSORT	FS	SORT AN ARRAY
TLUI	FS	TABLE SEARCH
TPLSORT	FS	SORT THREE ARRAYS
UAT0LA	GS	GMAP SUBR. TO CHANGE CASE OF ASCII CHAR. STRING (APPLIB

*****BF--BUSINESS AND FINANCE*****

ACCRUIT	B	COMPUTES AND PRINTS ACCRUED INTEREST ON INSTALLMENT LOAN
ANNUIT	B	ANNUITIES, LOANS, MORTGAGES
BALANCE	B	A PROGRAM TO RECONCILE A BANK STATEMENT BALANCE
BLDG COST	B	ANALYZE BUILDING COSTS
BONDATA	B	ANALYSIS OF A BOND INVESTMENT PORTFOLIO
BONDPR	B	COMPUTES PRICE AND ACCRUED INTEREST OF A BOND
BONDSW	B	CALCULATES THE EFFECT OF A BOND SWITCH
BONDYD	B	COMPUTES BOND YIELDS
CASHFLOW	B	PREDICTS NEXT YEARS CASH FLOW
DEPREC	B	CALCULATES DEPRECIATION BY FOUR METHODS
INSTLO	B	CALCULATES MONTHLY PAYMENT SCHEDULE ON INSTALLMENT LOAN
INTRSTZ	B	INTEREST RATES REGARDLESS OF PAYMENT STREAM --REGULATION
INVANL	FP	RETURN ON INVESTMENT ANALYSIS
LESSEE	B	COMPARES A LEASE WITH PURCHASE OF EQUIPMENT
LESSIM	B	SIMULATES LESSOR'S CASH FLOW AND RATE OF RETURN
LESSOR	B	CALCULATES THE LESSOR'S CASH FLOW & RATE OF RETURN
MAKE-BUY	B	TO MAKE OR TO BUY DECISIONS
MGSIM	FP	SIMULATES COMPETITIVE INTERACTION OF COMPANIES
MGSIM-IN		ON LINE INSTRUCTIONS FOR MGSIM
MORTCST	B	MORTGAGE SCHEDULE FOR VARIOUS TERMS
MORTGAGE	FP	CALCULATES A MORTGAGE REPAYMENT SCHEDULE
NOM-EFF	B	COMPUTES MULTIPLE EFFECTIVE ANNUAL RATES OF INTEREST
RETURN	B	COMPUTES ANNUAL RETURNS FOR A SECURITY FROM ANNUAL DATA
RISKIT	B	RISK ANALYSIS BASED ON HERTZ'S SIMULATION MODEL
SALDATA	B	COMPUTES PROFITABILITY OF DEPARTMENTS OF A FIRM
SAVING	B	SAVINGS PLAN CALCULATIONS
SIMFUND	B	SIMULATES LONG-RUN PERFORMANCE OF FUNDS(SIMPLOT)
SIMPLOT	B	PLOTTING PROGRAM FOR SIMFUND HISTOGRAMS
SMLBUS	B	PAYMENT SCHEDULES FOR A SMALL BUSINESS ADMST. LOAN
TRUINT	B	INTEREST RATE CALCULATIONS
VALSTK	B	CALCULATES INTRINSIC VALUE OF STOCK--MOLODOVSKY METHOD

END OF CATALOG

This BASIC program computes and prints the accrued interest on installment loans for inclusion in a lender's operating statement at the end of each month. The program computes the portion of unearned interest earned during the current month.

INSTRUCTIONS

To use ACCRUIT, enter the total unearned interest for each month remaining in the current year, plus the next 48 months. Loans are grouped by their month of maturity. Total unearned interest for each loan maturing in the month is determined, and the sum of all unearned interest on loans maturing in a month is used as input for the program. Therefore, this sum must be computed for each month being considered.

A customer credit manager calculates the amounts of unearned interest, by month of maturity, for all installment loans due in the next four years. Monthly totals are as follows:

	1973	1974	1975	1976	1977
Jan.		\$ 832.39	\$5755.1	\$ 5414.98	0
Feb.		936.14	5203.83	11028.33	\$ 844.86
March	\$800.50	654.66	4856.7	4660.57	0
April	98.35	1146.61	5819.73	7371.53	0
May	150.55	1521.3	2490.84	2572.17	898.64
June	270.66	1226.52	3283.03	3190.66	0
July	27.77	2083.25	4817.39	3712.78	0
Aug.	56.29	2455.6	1927.29	927.05	426.69
Sept.	2.65	1350.4	1867.08	0	0
Oct.	193.42	1597.11	2090.91	0	271.43
Nov.	326.4	2537.63	3912.03	790.34	0
Dec.	609.55	2362.95	7773.25	360.38	0

The unearned interest is computed using the sum of the months digits formula:

Interest earned during period = $2/(p+1)$ times unearned interest at beginning of the period, where p is the sequential number of the period in which the loans mature. Therefore, interest earned on loans maturing next month would be two-thirds of the interest unearned on those loans at the beginning of the current month.

Data is entered in the following order:

1. The line number, beginning with line 1000
2. The word DATA
3. The monthly unearned interest figures in chronological order, separated by commas

ACCRUIT-2

After entering the data, the credit manager types RUN and indicates the current month and year, using numeric notation. Since calculations wanted are for March 1973, the credit manager enters 3, 1973. ACCRUIT then prints a statement showing the portion of interest earned during the current month (March 1973) and the remaining unearned balance for each month.

SAMPLE PROBLEM

The data defined above, entered into the program as listed below, produces a sample run. Data for your problem replaces it.

* LIST 1000

```

1000 DATA 800.50,98.35,150.55,270.66,27.77,56.29
1010 DATA 2.65,193.42,362.4,609.55,832.39,936.14
1020 DATA 654.66,1146.61,1521.3,1226.52,2083.25,2455.6
1030 DATA 1350.4,1597.11,2537.63,2362.95,5755.1,5203.83
1040 DATA 4856.7,5819.73,2490.84,3283.03,4817.39,1927.29
1050 DATA 1867.08,2090.91,3912.03,7773.25,5414.98,11028.33
1060 DATA 4660.57,7371.53,2572.17,3190.66,3712.78,927.05
1070 DATA 0,0,790.34,360.38,0,844.86
1080 DATA 0,0,898.64,0,0,426.69
1090 DATA 0,271.43,0,0,0,0
99999 END

```

SAMPLE SOLUTION

```

SYSTEM ?BASIC
OLD OR NEW-OLD ACCRUIT
READY
*RUN

```

WHAT IS THE CURRENT MONTH AND YEAR(E.G. 12,1972 ?3,1973)

EARNED INTEREST - INSTALLMENT LOANS

<u>MONTH OF</u> <u>MATURITY</u> -----	<u>EARNED</u> <u>INTEREST</u> -----	<u>REMAINING UNEARNED</u> <u>INTEREST</u> -----
1973		
MARCH	\$800.50	\$0.00
APRIL	\$65.57	\$32.78
MAY	\$75.27	\$75.28
JUNE	\$108.26	\$162.40
JULY	\$9.26	\$18.51
AUGUST	\$16.08	\$40.21
SEPTEMBER	\$0.66	\$1.99
OCTOBER	\$42.98	\$150.44
NOVEMBER	\$72.48	\$289.92
DECEMBER	\$110.83	\$498.72

1974

JANUARY	\$138.73	\$693.66
FEBRUARY	\$144.02	\$792.12
MARCH	\$93.52	\$561.14
APRIL	\$152.88	\$993.73
MAY	\$190.16	\$1331.14
JUNE	\$144.30	\$1082.22
JULY	\$231.47	\$1851.78
AUGUST	\$258.48	\$2197.12
SEPTEMBER	\$135.04	\$1215.36
OCTOBER	\$152.11	\$1445.00
NOVEMBER	\$230.69	\$2306.94
DECEMBER	\$205.47	\$2157.48

1975

JANUARY	\$479.59	\$5275.51
FEBRUARY	\$416.31	\$4787.52
MARCH	\$373.59	\$4483.11
APRIL	\$431.09	\$5388.64
MAY	\$177.92	\$2312.92
JUNE	\$226.42	\$3056.61
JULY	\$321.16	\$4496.23
AUGUST	\$124.34	\$1802.95
SEPTEMBER	\$116.69	\$1750.39
OCTOBER	\$126.72	\$1964.19
NOVEMBER	\$230.12	\$3681.91
DECEMBER	\$444.19	\$7329.06

1976

JANUARY	\$300.83	\$5114.15
FEBRUARY	\$596.13	\$10432.20
MARCH	\$245.29	\$4415.28
APRIL	\$378.03	\$6993.50
MAY	\$128.61	\$2443.56
JUNE	\$155.64	\$3035.02
JULY	\$176.80	\$3535.98
AUGUST	\$43.12	\$883.93
SEPTEMBER	\$0.00	\$0.00
OCTOBER	\$0.00	\$0.00
NOVEMBER	\$34.36	\$755.98
DECEMBER	\$15.34	\$345.04

1977

JANUARY	\$0.00	\$0.00
FEBRUARY	\$34.48	\$810.38
MARCH	\$0.00	\$0.00
APRIL	\$0.00	\$0.00
MAY	\$34.56	\$864.08
JUNE	\$0.00	\$0.00
JULY	\$0.00	\$0.00
AUGUST	\$15.52	\$411.17
SEPTEMBER	\$0.00	\$0.00
OCTOBER	\$9.52	\$261.91
NOVEMBER	\$0.00	\$0.00
DECEMBER	\$0.00	\$0.00

TOTALS

\$9015.13-----
\$104529.15

ACCRUIT-4

The first column total indicates the total amount of interest earned during the present month (March 1973); the second column is the total unearned interest balance at the end of the month.

The unearned interest data provided by the program can be utilized as input for next month's run (April 1973), since it indicates total unearned interest as of the first of the month, assuming there are no new loans or early payments of outstanding loans. If either of these events occurs, adjust the unearned interest account for the month of maturity affected.

This BASIC program performs the calculations necessary for determining both payment and withdrawal annuities.

INSTRUCTIONS

To use this program, supply values for the variables as required by the problem.

Variables are denoted as follows:

- N is the number of periods
- P is the original principal amount
- A is the total amount at end of n periods
- I is the interest rate per period, in percent
- R is the amount of payment/withdrawal each period

For a payment annuity, you can give any three of N, A, I, R and find the fourth. Given values must be converted to a quarterly basis.

For a withdrawal annuity, you give any three of N, P, I, R and find the fourth. Given values must be converted to a monthly basis.

For loan or mortgage, use the withdrawal annuity option.

After each case, you can choose one of the following six alternatives:

1. Another case, same unknown variable
2. Another case, different unknown
3. Another case, other type of annuity
4. Total interest paid over n periods
5. Table of withdrawals, principal, and interest (use the "CTRL/@" key to stop table printout after the desired number of periods have been printed)
6. Stop the program

For additional instructions, list the program.

SAMPLE PROBLEM

Payment Option

Determine the amount on hand assuming a \$35-a-month deposit in the local bank. The bank pays $4\frac{7}{8}\%$ a year and compounds quarterly. After converting the following variables to a quarterly basis as illustrated, enter them as required:

ANNUIT-2

- $N = 3 \cdot 4 = 12$ periods
- $A =$ variable of interest
- $I = 4.875/4 = 1.21875/\text{period}$
- $R = 35 \cdot 3 = 105/\text{period}$

The above values of N, I, and R are entered as required.

The total interest, item 4, and table of withdrawals, item 5, alternatives do not apply to the payment option.

The answer (\$1842.65) is printed after selection of the proper options at lines 2 and 3 and the entry of (in proper sequence) N, I, and R at line 4. The answer does not account for any simple interest that might have been paid on \$35 deposits prior to the first compounding period.

Withdrawal Option

Determine the monthly principal and interest payments on a \$20,900 mortgage for 30 years at 5-1/2% per year. After converting the variables to a monthly basis:

- $N = 30 \cdot 12 = 360$ periods
- $P = 20900$
- $I = 5.5/12 = .458333333/\text{period}$
- $R =$ variable of interest

They are entered as required.

The answer (\$118.668) is printed when the proper options at lines 2 and 3 are entered (in proper sequence) N, P, and I, at line 4. The total interest and a payments table was obtained by answering 4 and 5, respectively, to the "another case" question. The "CTRL@" key was used to stop the table printout at period 17.

SAMPLE SOLUTION*RUN

ANNUIT

WANT INSTRUCTIONS FIRST (1=YES, 2=NO) ? 2WHICH ANNUITY TYPE (1=PAYMENT, 2=WITHDRAWAL) ? 1WHICH VARIABLE IS UNKNOWN (1=N, 2=A, 3=I, 4=R) ? 2WHAT ARE N(INTEGER), I(PCT), R(\$)? 16, 1.21875, 105.00

AMOUNT AT END OF N PERIODS = A = 1842.652

ANOTHER CASE (TYPE CODE NUMBER) ? 6

READY

*RUN

ANNUIT

WANT INSTRUCTIONS FIRST (1=YES, 2=NO) ? 2WHICH ANNUITY TYPE (1=PAYMENT, 2=WITHDRAWAL) ? 2WHICH VARIABLE IS UNKNOWN (1=N, 2=P, 3=I, 4=R) ? 4WHAT ARE N(INTEGER), P(\$), I(PCT) ? 360, 20900, .458333333

WITHDRAWAL EACH PERIOD = R = 118.6679

ANOTHER CASE (TYPE CODE NUMBER) ? 4

TOTAL INTEREST PAID = 21820.45

ANOTHER CASE (TYPE CODE NUMBER) ? 5

PERIOD	PRINCIPAL	INTEREST	PRINC BAL	INT TO DATE
0			20900	
1	22.88	95.79	20877.12	95.79
2	22.98	95.69	20854.14	191.48
3	23.09	95.58	20831.06	287.06
4	23.19	95.48	20807.86	382.54
5	23.3	95.37	20784.56	477.91
6	23.41	95.26	20761.16	573.17
7	23.51	95.16	20737.65	668.33
8	23.62	95.05	20714.03	763.38
9	23.73	94.94	20690.3	858.32
10	23.84	94.83	20666.46	953.15
11	23.95	94.72	20642.51	1047.87
12	24.06	94.61	20618.46	1142.48
13	24.17	94.5	20594.29	1236.98
14	24.28	94.39	20570.01	1331.37
15	24.39	94.28	20545.62	1425.65
16	24.5	94.17	20521.12	1519.82
17	24.61	94.06	20496.51	1613.88

This BASIC program assists in reconciling an error found in a DDA checking account.

METHOD

The program prints the ending balance in the ledger statement, subtracts outstanding checks from this balance, and adds outstanding deposits. From this new balance, the book balance at the end of the period, the total service charge is subtracted to obtain the adjusted book balance.

INSTRUCTIONS

Detailed program instructions can be obtained by listing lines 8-78. However, the Sample Program provides details for a run.

Information from the bank's statement is entered via data statements before a RUN. The program can easily be modified to read these data entries from an existing file used by the bank for maintaining demand deposits. However, information on this modification is not provided here since it is essential to know the format of the bank's demand deposits file.

SAMPLE PROBLEM

The use of BALANCE can best be shown by the following example. Unable to locate an error, Ms. Craig needs help in reconciling her latest checking account statement. She checked her statement and found for the month in question, three checks, numbers 888, 889, and 890, for \$1000, \$2000 and \$3000, respectively, had cleared. Furthermore, two deposits, each for \$1000, were made; and, after deducting the service charge and cost of new checks, \$5.55, the balance was \$2345.67.

In line 1690, after typing the word DATA, she enters the ending balance as shown in the bank's statement, and the total cost of new checks and/or service charges. These two data statements must be separated by a comma. Starting on the following line, she enters the check number and the check amount for each check the bank has cleared for the account during the period, again separating the two entries with a comma. After all checks have been entered, she types 0,0 in the next DATA statement. Then, starting in the next line, she enters the deposit number and deposit amount for her account. After she enters all deposits she again enter 0,0 in the last DATA line. When Ms. Craig types RUN, the program asks her to enter the check number and the amount of each check written during the period, including any checks outstanding based on the customer's records. Using her check-book, she enters the number and amount of all outstanding checks, separating each two

BALANCE-2

items of data with commas. No comma is used with each amount, such as to separate the hundreds from the thousands. Thus, \$1,500 becomes 1500. After the information for all checks written during the period has been entered, Ms. Craig types 0,0.

The program then compares the amounts of all checks already processed by the bank with the amounts just entered and prints a statement alerting the user to any check that may have been posted incorrectly. In this example, check number 889 is being carried on the bank's books with an amount of \$2000, as shown in DATA line 1710. However, Ms. Craig's records show an amount of \$2500. Therefore, the warning that check number 889 may be posted incorrectly is printed by the program.

Next, the program asks Ms. Craig for the numbers and amounts for all deposits made during the period, including outstanding deposits. She enters the data in the same manner as the check numbers and amounts. If deposits are not numbered, the dates when the deposits were made could be used (i.e., 621 for June 21st). Again Ms. Craig enters 0,0 after the last deposit. The program then compares all deposits shown by the bank with those just entered, and signals any discrepancies.

Finally, the program prints the balance on the bank's ledger statement, the numbers and amounts of outstanding checks and outstanding deposits, and the total service charge to arrive at an adjusted book balance for the account.

SAMPLE RUN

```
SYSTEM ?BASIC
OLD OR NEW-OLD BALANCE
READY
*1690 DATA 2345.67,5.55
*1700 DATA 888,1000
*1710 DATA 889,2000
*1720 DATA 890,3000
*1730 DATA 0,0
*1740 DATA 620,1000
*1750 DATA 621,1000
*1760 DATA 0,0
*RUN
```

RECONCILEMENT OF BANK ACCOUNT

PLEASE ENTER THE NUMBER AND AMOUNT OF EACH CHECK WRITTEN AND
ANY CHECKS OUTSTANDING AT THE BEGINNING OF THE PERIOD
(ENTER 0,0 WHEN COMPLETED)

ENTER NUMBER, AMOUNT

7888,1000

7889,2500

7890,3000

7891,500

7892,1500

70,0

CHECK NUMBER 889 MAY BE POSTED INCORRECTLY

PLEASE ENTER THE NUMBER AND AMOUNT OF EACH DEPOSIT MADE AND
ANY OUTSTANDING AT BEGINNING OF PERIOD
(ENTER 0,0 WHEN COMPLETED)

ENTER NUMBER, AMOUNT

7620,1000

7621,1000

7622,500

7623,1000

70,0

ENDING BALANCE ON STATEMENT	2345.67
-----------------------------	---------

SUBTRACT OUTSTANDING CHECKS:

NUMBER	AMOUNT
--------	--------

891	500.00
-----	--------

892	1500.00
-----	---------

2000.00

ADD DEPOSITS OUTSTANDING:

622	500.00
-----	--------

623	1000.00
-----	---------

1500.00

BANK BALANCE AT END OF PERIOD

1845.67

SERVICE CHARGES

5.55

ADJUSTED BANK BALANCE

1840.12

REVIEW OUTSTANDING CHECKS AND DEPOSITS FOR CORRECT AMOUNTS!

This BASIC program analyzes the feasibility of building design proposals. Essentially, the program keeps track of the major building costs and projects them over the life of the building. The program allows the designer or builder to see the effect of changes in construction costs, operating costs, financing costs, and replacement costs on the total cost over the life of the building and on the minimum annual rent required to make the project economically feasible.

INSTRUCTIONS

The input required for this program is as follows:

MAJOR CAPITAL COSTS OF THE PROJECTS

1. Building construction costs
2. Land cost
3. Land development cost
4. Equipment cost

FINANCING DETAILS

1. Mortgage or bond financing
2. Amount of total capital cost to be financed
3. Length of financing period
4. Interest rate

REPLACEMENT

1. Total life of the building
2. 1, if the cost of replacement is to be covered by a sinking fund, otherwise, 2
3. The value and life of each item to be replaced

ANNUAL OPERATION COST

1. Insurance cost
2. Utility cost and air-conditioning cost
3. Property tax and building service cost
4. Maintenance and repair cost (2% annual increase allowed for aging of structure)

SALVAGE VALUE OF THE BUILDING AT THE END OF ITS LIFE

INTEREST LOST

Amount of total project cost to be used in computing interest lost.

To use this program enter data as requested. These instructions can be found by running the program.

SAMPLE PROBLEM

Analyze the feasibility of a project with planned construction costs of \$15,000, land costs of \$3,000, development costs of \$1,000, and equipment costs of \$200, where \$15,000 of the

BLDGCOST-2

total project cost is to be financed by a 7-year mortgage at 5-1/4%. Print a year-by-year financing table when that option is presented. The following are the values and life expectancy of items to be replaced:

\$200, 5 years
\$150, 3 years
\$500, 15 years
\$100, 4 years

Annual costs will be as follows: insurance, \$100; utilities, \$160; air conditioning, \$240; property taxes, \$600; building service, \$50; maintenance and repair, \$500. At the end of 10 years, the salvage value of the building is expected to be \$15,000. The amount of money to be used in interest loss computations is \$4,200.

SAMPLE SOLUTION

*RUN BLDGCOST

BLDGCOST

PROGRAM FOR BUILDING COST ANALYSIS

DO YOU WANT INSTRUCTION? ANSWER 1 FOR YES AND 0 FOR NO

? 0

INPUT MAJOR CAPITAL COST & VALUE AFTER ?

BUILDING CONSTRUCTION COSTS. ? 15000
LAND COST..... ? 3000
LAND DEVELOPMENT..... ? 1000
EQUIPMENT COST..... ? 200

TOTAL CAPITAL COSTS=\$ 19200

IS THE PROJ TO BE FINANCED BY: 1=MORT., 2=BONDS.

? 1

WHAT AMOUNT IS TO BE BORROWED, LENGTH OF PERIOD, AND
INTEREST RATE INPUT BY TYPING \$ AMOUNT, YEARS, PERCENT

? 15000, 7, 5.25

UNIFORM ANNUAL PAYMENT REQUIRED = \$ 2615.833

DO YOU WANT FINANCING TABLE PRINTED TYPE 1 YES 2 NO

? 1

YEAR	INTEREST	PRINCIPAL	BALANCE
0			15000
1	787.5	1828.333	13171.67
2	691.5125	1924.32	11247.35
3	590.4857	2025.347	9221.999
4	484.155	2131.678	7090.321
5	372.2419	2243.591	4846.73
6	254.4533	2361.38	2485.351
7	130.4809	2485.352	0

R E P L A C E M E N T S E C T I O N

WHAT IS THE TOTAL LIFE OF THE BUILDING ? 10

IS THE COST OF REPLACEMENT TO BE COVERED BY A SINKING FUND?

TYPE 1 YES 2 NO (INTEREST RATE 4 PERCENT) ? 1

INPUT THE \$ VALUE AND THE LIFE OF EACH ITEM TO BE REPLACED
IF ALL ITEMS TO BE REPLACED HAVE BEEN ENTERED TYPE 0,0 AFTER?

FIRST ITEM \$ VALUE, LIFE IN YEARS DONT FORGET THE COMMA

? 200, 5

NEXT ITEM \$ VALUE, LIFE IN YEARS -

? 150, 3

NEXT ITEM \$ VALUE, LIFE IN YEARS

? 500, 15

NEXT ITEM \$ VALUE, LIFE IN YEARS

? 100, 4

NEXT ITEM \$ VALUE, LIFE IN YEARS

? 0, 0

UNIFORM ANNUAL SINKING FUND PAYMENT FOR REPLACEMENT = \$ 133.4972

A N N U A L O P E R A T I O N C O S T S E C T I O N

WHAT IS THE ANNUAL COST OF THE FOLLOWING ITEMS

INPUT BY TYPING \$ VALUE AFTER ?

INSURANCE COST ? 100

UTILITY COST..... ? 160

AIR CONDITIONING COST..... ? 240

PROPERTY TAXES..... ? 600

BUILDING SERVICE COST..... ? 50

MAINTENANCE AND REPAIR..... ? 500

AVERAGE TOTAL ANNUAL OPERATION COST = \$ 1650

BLDG COST-4

DEPRECIATION IS COMPUTED ON STRAIGHT LINE
BASIS. WHAT IS THE SALVAGE VALUE OF THE BUILDING AT YEAR 10
? 15000

ANNUAL DEPRECIATION= 20

INTEREST LOST SECTION

WHAT AMOUNT OF MONEY INVESTED IN THE PROJECT SHOULD BE
USED FOR THE INTEREST LOST COMPUTATION

? 4200

INTEREST LOST AT 8 % INTEREST RATE =\$ 3360

INTEREST LOST AT 6 % INTEREST RATE =\$ 2520

INTEREST LOST AT 4 % INTEREST RATE =\$ 1680

DO YOU WANT THE TABLE PRINTED OUT TYPE 1 YES 2 NO

? 2

TOTAL LOAN PAYMENTS.....=\$ 18310.83

TOTAL SINKING FUND PAYMENTS.=\$ 1334.972

TOTAL OPERATION COST.....=\$ 16550

TOTAL COST=\$ 36075.92

THE MINIMUM ANNUAL RENT =\$ 3775.592 THIS IS THE

TOTAL COST 36075.92 PLUS THE INTEREST LOST (AT 4 PERCENT) 1680
DIVIDED BY THE LIFE OF THE BUILDING 10

This BASIC program prepares five reports on the analysis of the composition of a bond investment portfolio.

INSTRUCTIONS

Data is entered in the following order:

1. Description of the bond - bond terminology
2. Type - (government, municipal, federal agency, other)
3. Moody Rating - (N.A. BAA etc.)
4. Par Value - (500,000, 300,000, etc.)
5. Coupon Rate/Percent Form - (3.5, 5, etc.)
6. Coupon Payment Dates - (month, day, month, day (integers))
7. Book Price Per Bond - (95.5, 100, etc.)
8. Purchase Date - year, month, day
9. Maturity Date - year, month, day
10. Current Market Price

A sample entry for one issue follows:

1.5 Apr. '69, mun., BAA
10000, 1.5, 4, 1, 10, 1, 91.6, 1960, 6, 2, 1969, 4, 1, 95.7

Sample data is presently entered starting in line 9000.

Once a data file is built, enter it in place of the sample data. Then type RUN. The program will ask which reports are desired. In addition, requests are made for ordinary income tax rate, capital gains tax rate, and period (in years) to be analyzed. The five reports available are the portfolio breakdown by:

1. Years of maturity
2. Bond type
3. Moody rating
4. Coupon income
5. Individual issues maturity.

SAMPLE PROBLEM

Generate portfolio breakdowns by years of maturity, bond type, Moody rating, coupon income, and individual issues maturity. Your ordinary income tax rate is 48%; your capital gains rate is 25%. Generate coupon income information for the years 1972 through 1973 and individual issue maturity information for the years through 1975. Other data is the same as sample above.

SAMPLE SOLUTION

THIS PROGRAM PREPARES FIVE REPORTS WHICH ANALYZE THE COMPOSITION OF A BOND INVESTMENT PORTFOLIO.

DO YOU REQUIRE A DESCRIPTION OF HOW TO BUILD A DATA FILE ?N0

ENTER YES OR NO IF YOU WOULD LIKE THE FOLLOWING REPORTS:

I. PORTFOLIO BREAKDOWN BY YEARS OF MATURITY ?YES

II. PORTFOLIO BREAKDOWN BY BOND TYPE ?YES

III. PORTFOLIO BREAKDOWN BY MOODY'S RATING ?YES

IV. PORTFOLIO BREAKDOWN BY COUPON INCOME ?YES

FOR WHAT YEARS WOULD YOU LIKE THIS INFORMATION (I.E. FOR YEARS 1968-1978, ENTER 1968,1978) ?1972,1973

V. PORTFOLIO BREAKDOWN BY INDIVIDUAL ISSUE MATURITY ?YES

FOR WHAT YEARS WOULD YOU LIKE THIS INFORMATION (I.E. FOR YEARS 1968-1978, ENTER 1968,1978) ?1972,1975

WHAT IS YOUR ORDINARY INCOME TAX RATE(ENTER INTEGER) ?48

WHAT IS YOUR CAPITAL GAINS TAX RATE(ENTER INTEGER) ?25

WHAT IS TODAY'S DATE (ENTER THE YEAR, THE MONTH, AND THE DAY: 1968,6,26) ?1972,7,8

I. PORTFOLIO BREAKDOWN BY YEARS OF MATURITY

YEARS TO MATURITY	NO. OF ISSUES	PAR VALUE	PAR VALUE PERCENT OF TOTAL	AFTER TAX YIELD AT BOOK AT MARKET
0 -	1	0	0	0
1 -	2	2	250000	5
2 -	3	2	600000	12
3 -	4	3	1100000	22
4 -	5	2	600000	12
5 -	6	0	0	0
6 -	7	0	0	0
7 -	8	0	0	0
8 -	9	0	0	0
9 -	10	0	0	0
11 -	15	4	800000	16
16 -	20	3	550000	11
21 -	25	1	250000	5
26 -	30	3	700000	14
31 -	35	1	100000	2
TOTALS	21	4950000	100	2.9

II. PORTFOLIO BREAKDOWN BY BOND TYPE

BOND TYPE	NUMBER OF ISSUES	PAR VALUE	PAR VALUE AS PERCENT OF TOTAL
GOV'T	6	1350000	27
MUN.	6	1500000	30
FED. AGENCY	5	900000	18
OTHER	4	1200000	24
TOTALS	21	4950000	100

BOND TYPE	BOOK VALUE	AFTER-TAX YIELD AT BOOK VALUE	MARKET VALUE	A-T YLD. MARKET
GOV'T	1315255	2.39	1324850	2.57
MUN.	1421100	4.15	1433630	4.94
FED. AGENCY	828000	2.44	855100	2.45
OTHER	1160000	2.27	1171210	2.42
TOTALS	4724355	2.9	4784790	3.23

III. PORTFOLIO BREAKDOWN BY MOODY'S RATING

RATING	NUMBER OF ISSUES	PAR VALUE	PAR VALUE AS PERCENT OF TOTAL	AFTER-TAX YIELD	
				AT BOOK	AT MARKET
AAA	2	350000	7	2.4	3.39
AA	1	300000	6	4.03	4.07
A	2	500000	10	2.36	2.39
BAA	5	1300000	26	3.46	4.1
BA	2	450000	9	2.91	2.96
B	1	300000	6	2.25	2.79
N.R.	2	400000	8	3.56	3.56
N.A.	6	1350000	27	2.39	2.57
TOTALS	21	4950000	100	2.9	3.23

IV. PORTFOLIO BREAKDOWN BY COUPON INCOME

----- 1972 -----

DATE	DESCRIPTION	TYPE	BEFORE-TAX INCOME	AFTER-TAX +AMT,SVG
1 FEB. 1972	3.75 AUG.'73	GOV'T	2812.5	1462.5
1 FEB. 1972	4 FEB.'85	GOV'T	3000	1560
1 FEB. 1972	5.12 FEB.'75	GOV'T	10240	5507.657
1 FEB. 1972	5.12 FEB.'77	GOV'T	7680	4075.392
1 FEB. 1972	4 AUG.'76	MUN.	6000	6000
1 FEB. 1972	4 FEB.'87	FED. AGENCY	3000	1560
1 FEB. 1972	3.84 AUG.'72	OTHER	5760	2995.2
1 FEB. 1972	4.6 FEB.'85	OTHER	9200	4830.829
1 FEB. 1972	3 FEB.'01	OTHER	4500	2340
1 MAR. 1972	3.25 MAR.'00	FED. AGENCY	1625	845
1 MAR. 1972	5 MAR.'90	OTHER	5000	2637.647
			58817.5	33814.22
QUARTERLY ACCRUED COUPON INCOME			49954.99	32600.59
1 APR. 1972	1.5 APR.'74	MUN.	750	750
1 APR. 1972	4.6 APR.'75	MUN.	4600	4600

V. PORTFOLIO BREAKDOWN BY INDIVIDUAL ISSUE MATURITY

DATE	DESCRIPTION	TYPE	PAR VALUE +COUPON	PAR VALUE +CPN.-TAX
1 AUG. 1973	3.75 AUG.'73	GOV'T	152812.5	150086.2
1 APR. 1974	1.5 APR.'74	MUN.	100750	98650
1 FEB. 1975	5.12 FEB.'75	GOV'T	410240	405507.7
1 APR. 1975	4.6 APR.'75	MUN.	204600	204600
1 AUG. 1975	3.84 AUG.'72	OTHER	305760	300745.2
1 OCT. 1975	5.12 OCT.'75	FED. AGENCY	307680	304124.5
1 NOV. 1975	4 NOV.'75	MUN.	510000	497500
			1738280	1712477

This BASIC program computes the price and accrued interest for a bond accounting for the annual coupon in dollars, the redemption value, the maturity, and the yield. The purchase of a bond involves the payment of a purchase price plus accrued interest. In exchange for this investment, the purchaser who holds the bond to maturity expects to receive interest payments, usually semiannually, and a principal payment at maturity. The interest payments are the so-called "coupon" payments. The payment at maturity is usually the "par" or face value of the bond, although in some cases there may be a premium stipulated in the bond. If the terms of the bond make it callable before maturity, the purchaser may anticipate receiving interest only up to a call date, and then receiving the par value of the bond plus a specified call premium.

INSTRUCTIONS

The program inquires about the method of entering data as follows:

DO YOU WANT INSTRUCTIONS FOR ENTERING DATA?

There are three options:

1. If you answer YES, the program will print out a description of each line of data to be entered; enter the data one line at a time.
2. If you answer NO, the program will ask for items 1 through 5 to be entered; enter the data, separated by commas, on one line.
3. If you answer DATA, the data already in the program will be printed out.

See the Sample Problem for examples of all three methods discussed above.

All data is expressed per hundred dollars per value of the bond.

SAMPLE PROBLEM

In this example, the user has specified an annual coupon of \$6 a year (\$3 paid semi-annually), a principal payment of \$100 at maturity, maturity in 12 years 5 months, and a yield to maturity of 5-1/2%. The computer summarizes the specified data, so that the user can spot a mistake quickly, and then prints out the calculated price, \$104.45, and the accrued interest of \$.50. The price calculation is an exact one; no interpolation is used. The accrued interest is calculated from the coupon specified and the maturity. In this example, since the bond matures in 12 years and 5 months, the last coupon payment must have been made one month ago and, therefore, one month of interest must have accrued. One-sixth of \$3 is \$.50, and this is the figure printed out for accrued interest. The program assumes that where the

time to maturity is an exact multiple of 6 months (that is, where the present date is a coupon payment date), the purchaser is buying just before the coupon is received. In such a case, the accrued interest would be shown as a full half-year coupon payment.

SAMPLE SOLUTION

* RUN

DO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?YES

ENTER THE FOLLOWING ITEMS OF DATA

ITEM 1 ANNUAL COUPON IN DOLLARS ? 6
 ITEM 2 PROCEEDS ON REDEMPTION ? 100
 ITEMS 3 & 4 MATURITY IN YEARS, MONTHS ? 12, 5
 ITEM 5 YIELD TO MATURITY ? .055

COUPON 6 REDEMPTION AT 100
 MATURITY 12 YEARS 5 MONTHS
 YIELD .055

PRICE 104.4505 ACCR INT .5000002

READY

*RUN

DO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?NO

ENTER ITEMS 1 THROUGH 5 ?6, 100, 12, 5, .055

COUPON 6 REDEMPTION AT 100
 MATURITY 12 YEARS 5 MONTHS
 YIELD .055

PRICE 104.4505 ACCR INT .5000002

READY

*RUN

DO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?DATA

COUPON 6 REDEMPTION AT 100
 MATURITY 12 YEARS 5 MONTHS
 YIELD .055

PRICE 104.4505 ACCR INT .5000002

This BASIC program calculates the effect of a bond switch (that is, a bondholder selling a bond and purchasing another, expecting that a change in yield spread will make the switch profitable). The user supplies information about the bonds, tax rates, yield forecasts, and reinvestment rates. Then, the program calculates terminal values for three alternatives: keeping the old bond, making a pure tax switch (selling and repurchasing the same issue), and selling the old bond and purchasing a new one.

A simple example: if the present spread between high-grade utility bonds and government bonds is 116 basis points, and an accurate forecast is a reduction of this spread to 90 basis points at some future date, prices of utility bonds will rise relative to prices of government bonds and there is money to be made (or a loss to be avoided) in a switch from government to utility bonds.

The basic calculation involved in evaluating a bond switch is fairly straightforward in principle. The user of BONDSW must supply the vital statistics for the bond he presently owns (the "old" bond) and the bond to which he is thinking of switching (the "new" bond), some information with respect to his tax rates, his yield forecast, and an estimate of the rate of interest he will obtain on the reinvestment of coupon interest income. He must also indicate the length of time to the terminal date (this being the date for which his interest rate forecasts are made) he has in mind. Any terminal date may be chosen, up to the maturity of the shorter of the two bonds.

The program will calculate the terminal values (the number of dollars, after income tax, that the investor will have after selling out at the terminal date) for three alternatives: keep the old bond, make a pure tax switch, and sell the old bond and purchase a new one. The first of these alternatives is simple enough. The investor keeps the old bond until the terminal date and then sells it at a price that is a function of his yield forecast for that terminal date. The program BONDSW takes into account taxes on coupon interest received, the tax reduction due to amortization of any premium (based on the present book value of the old bond), and any taxes arising from gain or loss at the terminal date. The user of the program must furnish a variety of tax rates so that tax exempt bonds may be considered in switch decisions, and either gain or loss years may be forecasted for a bond-switching decision.

The second alternative is a pure tax switch. That is, the program assumes that the old bond is sold now and the net proceeds after taxes are immediately reinvested in the same bond, which is held to the terminal date and then resold.

The third alternative is a switch from the old bond to the new bond. The program calculates the net after-tax proceeds of selling the old bond, invests this amount in the new bond, and calculates, again after all tax effects, the number of dollars the investor will have after selling this new bond at the terminal date.

Terminal value is chosen as the best measure of the attractiveness of a bond switch because it is a relatively unambiguous figure. It is, of course, sensitive to some extent to the rate that has been specified for the return on reinvested coupon interest. The investor may be in some doubt about what rate he will receive as he reinvests coupon payments, but he can always try several rates and see what difference it makes to the terminal value comparison. Perhaps, a more obvious comparison measure would be yield. BONDSW actually does calculate the yield to the terminal dates for the three alternatives. This figure is an ordinary after-tax bond yield. It is simply the rate that discounts the net after-tax proceeds of sale at the terminal date, and the net after-tax coupon receipts, back to the price of the old bond (which is what the investor now has). The yield to terminal date is, however, an ambiguous figure. The difficulty comes in deciding the amount on which the yield should be calculated: the market price of the old bond or the amount the investor would net after taxes if he were to sell the old bond. It is impossible to say which of these choices is "correct," but the program bases this yield to terminal date on the market price of the old bond.

In theory, at least, the yield-to-sale date is a less attractive comparative measure than the terminal value; but because yield is probably a more familiar concept than terminal value to most bond men, the program has been set up to delivery yield figures as well as terminal value.

INSTRUCTIONS

The program inquiries about the method of entering data as follows:

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA?

There are three options:

1. If you answer YES, the program will print out a description of each line of data to be entered; enter the data one line at a time.
2. If you answer NO, the program will ask for the data to be entered in lines one through five; enter the data, separated by commas, on one line.
3. If you answer DATA, the data already in the program will be printed out.

See the Sample Problem for examples of all three methods discussed above.

SAMPLE PROBLEM

In this case the old bond has a book value of \$90-3/8, a current quoted price of \$91, an annual coupon of 2-3/4, and a maturity of 2 years and 5 months. The proceeds at redemption (including any call premium) are \$100, and the tax rate applicable to coupon interest payment on this bond is 48%. The quoted price of the new bond is \$84, the coupon is 5-1/8, the maturity is 32 years and 9 months, the amount to be received at redemption is \$100, and the tax rate to be applied to coupon interest payment on this bond is also 48%. The terminal date the investor has in mind is 2 years and 0 months in the future, and forecasts a yield of 5% on the old bond and 4-1/2% on the new bond at that date. Capital loss and capital gain tax rates now and at the terminal date are all 25%. Tax rates on capital gains at maturity on the old and the new bonds are also 25%. Finally, the investor has estimated a gain of 3% a year after taxes on the reinvestment of coupon interest up to the terminal date.

(The data above correspond to a testing of a choice between keeping an AT&T 2-3/4% debenture maturing in 1972, and switching to an AT&T 5-1/8% debenture maturing in 2001, where the investor is looking two years ahead.)

* LIST 10-230

```

10REM BONDSW          (BASIC PROGRAM BEGINS AT LINE 110)
14REM *****          ::::::::::          *****
15REM
20REM THIS BASIC PROGRAM IS TO CALCULATE AND ANALYZE THE
25REM EFFECT OF A BOND SWITCH
26REM
27REM *****
36REM TYPE "RUN" TO USE. DATA INPUTS ARE DESCRIBED IN
37REM PRINT STATEMENTS.
50REM
55REM * * * * *
60REM
110REM DESCRIPTION OF VARIABLES IN DATA
120REM C1,C2: ANNUAL COUPON ON OLD AND NEW BONDS
130REM B1: BOOK VALUE OLD BOND
140REM P1,P2: PRICE OLD AND NEW BONDS
150REM M1,M3,M2,M4: MATURITIES OLD AND NEW BONDS IN YEARS AND MONTHS
160REM R1,R2: REDEMPTION PRICE OLD AND NEW BONDS
170REM T1,T2: TAX RATE ON THE INTEREST OF OLD AND NEW BONDS
180REM S1,S2: TERMINAL DATE IN YEARS AND MONTHS HENCE
190REM Y3,Y4: ESTIMATED YIELD ON OLD AND NEW BONDS AT TERMINAL DATE
200REM T3,T5: CAPITAL LOSS RATE NOW AND AT TERMINAL DATE
210REM T4,T6: CAPITAL GAIN RATE NOW AND AT TERMINAL DATE
220REM D3,D4: CAPITAL GAIN RATE AT MATURITY OF OLD AND NEW BOND
230REM Y9: AFTER TAX REINVESTMENT RATE FOR COUPONS

```

A run of BONDSW is illustrated below. In this run, the data must already be available in the program's data lines:

```
1110 DATA 90.375,91,2.75,2.5,100,.48
1120 DATA 84.5,125,32,9,100,.48
1130 DATA 2,0,.05,.045
1140 DATA .25,.25,.25,.25
1150 DATA .25,.25
1160 DATA .03
```

When the program responds by asking which of five tables is wanted, the investor replies by typing 0. This enables verification of data input.

```
DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?DATA
TABLE OF YIELDS AND TERMINAL VALUES AT TERM. DATE TYPE:
  0-FOR NO TABLES
  1-FOR SENSITIVITY OF YIELD AND TERMINAL VALUES TO TERM.
  2-FOR SENSITIVITY TO YIELD SPREAD
  3-FOR SENSITIVITY TO YIELDS
  4-FOR YIELDS AND TERMINAL VALUES AT YOUR TERM. DATE
```

WHICH TABLE DO YOU WANT ?0

DO YOU WANT A SUMMARY OF BOND DATA ?YES

SUMMARY OF DATA

YIELDS TO MATURITY

YIELD ON OLD BOND BEFORE TAX	6.85
YIELD ON OLD BOND AFTER TAX	4.44
YIELD ON REPURCHASED OLD BOND AFTER TAX	4.51
YIELD ON NEW BOND BEFORE TAX	6.28
YIELD ON NEW BOND AFTER TAX	3.41

OLD BOND

PRESENT PRICE	91	Coupon	2.75
REDEMPTION AT	100	BOOK VALUE	90.375
MATURITY	2 YEARS		5 MONTHS
TAX RATES	.48 ON INC	.25 ON CAP GNS	
	.25 ON CAP LOSSES	.25 ON CAP GNS AT MATURITY	
YIELD BEF TAX FORECAST FOR SALE DATE			.05

NEW BOND

PRESENT PRICE	84	Coupon	5.125
REDEMPTION AT	100		
MATURITY	32 YEARS		9 MONTHS
TAX RATES	.48 ON INC	.25 ON CAP GNS AT MATURITY	
YIELD BEF TAX FORECAST FOR SALE DATE			.045

SALE DATE IS IN	2 YEARS	0 MONTHS
TAX	.25 ON CAP LOSS	.25 ON CAP GNS
OPPORTUNITY RATE A/T	.03	

SAMPLE SOLUTION

Illustrated below is an example of entering data in the interactive mode.

*RUN

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?YES

ENTER THE FOLLOWING ITEMS OF DATA

ITEM 1	BOOK VALUE OF OLD BOND	<u>?90.375</u>
ITEM 2	PRICE OF OLD BOND	<u>?91</u>
ITEM 3	COUPON ON OLD BOND	<u>?2.75</u>
ITEMS 4 & 5	MATURITY OLD BOND IN YRS, MONTHS	<u>?2,5</u>
ITEM 6	PROCEEDS ON REDEMPTION OLD BOND	<u>?100</u>
ITEM 7	TAX RATE ON OLD BOND INTEREST PMTS	<u>? .48</u>
ITEM 8	PRICE OF NEW BOND	<u>?84</u>
ITEM 9	COUPON ON NEW BOND	<u>?5.125</u>
ITEMS 10,11	MATURITY NEW BOND- YRS, MONTHS	<u>?32,9</u>
ITEM 12	PROCEEDS ON REDEMPTION NEW BOND	<u>?100</u>
ITEM 13	TAX RATE ON NEW BOND INTEREST PMTS	<u>? .48</u>
ITEMS 14,15	YRS, MONTHS TO TERMINAL DATE	<u>?2,0</u>
ITEM 16	PREDICT YIELD OLD BOND TERM. DATE	<u>? .05</u>
ITEM 17	PREDICT YIELD NEW BOND TERM. DATE	<u>? .045</u>
ITEMS 18,19	CAP LOSS, GAIN RATES NOW	<u>? .25, .25</u>
ITEMS 20,21	CAP LOSS, GAIN RATES TERM. DATE	<u>? .25, .25</u>
ITEM 22	CAP GAIN RATE AT MATURITY OLD BOND	<u>? .25</u>
ITEM 23	CAP GAIN RATE AT MATURITY NEW BOND	<u>? .25</u>
ITEM 24	AFTER TAX REINVEST RATE COUPONS	<u>? .03</u>

TABLE OF YIELDS AND TERMINAL VALUES AT TERM. DATE TYPE:

0-FOR NO TABLES

1-FOR SENSITIVITY OF YIELD AND TERMINAL VALUES TO TERM.

2-FOR SENSITIVITY TO YIELD SPREAD

3-FOR SENSITIVITY TO YIELDS

4-FOR YIELDS AND TERMINAL VALUES AT YOUR TERM. DATE

WHICH TABLE DO YOU WANT ?1

SENSITIVITY OF YIELD AND TERM. VALUE TO TERM. DATE AT TERM.

TERM. DATE (IN YEARS)	YIELD TO TERMINAL DATE			TERMINAL VALUE		
	OLD BOND	TAX SW.	NEW BOND	OLD BOND	TAX SW.	NEW BOND
.5	9.36	9.34	50.17	96.11	96.1	115.28
1	6.24	6.23	25.22	96.87	96.86	115.22
1.5	5.21	5.2	17.47	98.4	98.39	116.65
2	4.7	4.7	13.69	99.96	99.94	118.09
2.5	4.4	4.4	11.46	101.54	101.53	119.56
3	4.2	4.2	9.98	103.16	103.14	121.05

The first table illustrates that for the two-year time horizon a tax switch is actually disadvantageous, but a switch into the new bond offers a substantial advantage, the terminal value rising from about \$100 to about \$118. In addition, the dollar advantage in terminal value is about the same whether the yield forecasts are achieved in half a year or three years. If they are achieved early, as yield comparisons show, the terminal advantage will be earned quickly and the switch will prove that much more profitable.

After printing the sensitivity table, the program asks the investor again which table is wanted. By typing 2, the user indicates the table of sensitivity of yields and terminal values to the yield spread. For this table, the program needs more information; therefore, it asks the investor to supply the range of spreads over which the analysis should be made. In our example, a range has been specified from a spread of -100 basis points to a spread of +100 basis points, and has indicated the desire to see the results for steps of 30 basis points. (The yield originally forecasted for the old bond will be used for the table, and the yield forecast for the new bond will be varied in steps of 30 basis points.)

The computer has printed the yield comparison and the terminal value comparison for yield spreads between the old and new bond at the terminal date (-100 basis points, -70 basis points, -40 basis points, and so on down to +80 basis points). (It does not show the comparison for a spread of +100 basis points, of course, because steps of 30 beginning at -100 will not reach +100.) The spread that was actually supplied in the original data was -50 points. As the second table illustrates, the more negative the spread at the terminal date, the more profitable the switch will prove. In addition, even if the spread is as high as +80 basis points, the switch will still be profitable. To see at exactly what point the switch would become unprofitable, the program could be rerun supplying different high and low spreads.

WHICH TABLE DO YOU WANT ?2

DESIGNATE RANGE OF SPREAD(NEW BOND YIELD-OLD BOND YIELD AT
TERMINAL DATE) INPUT HIGH SPREAD, LOW SPREAD AND INCREMENT
IN BASIS POINTS. FOR EXAMPLE, -100,100,25.
?-100,100,30

SENSITIVITY OF YIELD AND TERMINAL VALUE TO SPREAD AT TERM.
OLD BOND YIELD HELD CONSTANT.

SPREAD YIELD TO TERMINAL DATE TERMINAL VALUE
(IN BASIS PTS.)

	OLD BOND	TAX SW.	NEW BOND	OLD BOND	TAX SW.	NEW BOND
-100	4.7	4.7	17.13	99.96	99.94	125.71
-70.00001	4.7	4.7	15.04	99.96	99.94	121.03
-40.00001	4.7	4.7	13.03	99.96	99.94	116.67
-10.00002	4.7	4.7	11.11	99.96	99.94	112.61
19.99998	4.7	4.7	9.26	99.96	99.94	108.83
49.99998	4.7	4.7	7.49	99.96	99.94	105.29
79.99997	4.7	4.7	5.8	99.96	99.94	101.99

Once again, the program asks the investor to specify which is wanted. This time, the investor has typed 3, indicating that a table of sensitivity of yields and terminal values to the yield forecast is made. When the original data was supplied, an estimated yield of 5% at the terminal date on the old bond and 4-1/2% at the terminal date on the new bond was specified. As the printout below indicates, the computer asks the investor to specify a high and a low yield for the old bond at the terminal date, and to indicate the steps the computer should go through in printing the yield and terminal value comparisons. The investor has indicated that he would like to look at comparisons over the range from a 5 to a 6% yield on the old bond at the terminal date, in steps of 20 basis points.

WHICH TABLE DO YOU WANT ?3

DESIGNATE RANGE OF OLD BOND YIELDS AT TERMINAL DATE.
INPUT HIGH YIELD, LOW YIELD AND INCREMENT DESIRED, FOR EXAMPLE:
.06, .05, .002.
?.06, .05, .002

SENSITIVITY OF YIELD AND TERM. VALUE TO YIELD AT TERM.
SPREAD HELD CONSTANT.

YIELD (OLD BOND)	YIELD TO TERMINAL DATE			TERMINAL VALUE		
	OLD BOND	TAX SW.	NEW BOND	OLD BOND	TAX SW.	NEW BOND
.05	4.7	4.7	13.69	99.96	99.94	118.09
.052	4.67	4.66	12.38	99.9	99.88	115.29
.054	4.64	4.63	11.11	99.84	99.82	112.61
.056	4.61	4.6	9.87	99.77	99.76	110.06
.058	4.58	4.57	8.66	99.71	99.7	107.62
.06	4.55	4.54	7.49	99.65	99.64	105.29

For this table, the yield spread has been held constant at the -50 basis points originally specified when the data was placed in the program. As the third table illustrates, if the yield spread at the terminal date turns out to be the -50 basis points that the investor has estimated, the comparison is still sensitive to the general yield level. If the old bond is yielding 6% two years in the future, rather than the 5% estimated by the investor, the switch will still prove profitable, but considerably less profitable.

Next, the program asks again which table the investor would like. This time the answer is 4, indicating that the investor would simply like to see the yield and terminal values corresponding to the date originally supplied to the program. As shown below, the computer then prints these yields and terminal values.

WHICH TABLE DO YOU WANT ? 4

YIELD TO SALE DATE A/T IF OLD BOND KEPT	4.703 PERCENT
YIELD TO SALE DATE A/T ON TAX SWITCH	4.695
YIELD TO SALE DATE A/T ON SWITCH TO NEW BD	13.689

TERMINAL VALUE IF OLD BOND KEPT	99.96
TERMINAL VALUE OF TAX SWITCH	99.94
TERMINAL VALUE OF SWITCH TO NEW BOND	118.09

Example 2 illustrated below is the method of entering data by line.

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ? N0
ENTER DATA ITEMS 1 THROUGH 13

?90.375,91,2.75,2,5,100,.48,84,5.125,32,9,100,.48

ENTER DATA ITEMS 14 THROUGH 24

?2,0,.05,.045,.25,.25,.25,.25,.25,.25,.03

TABLE OF YIELDS AND TERMINAL VALUES AT TERM. DATE TYPE:

0-FOR NO TABLES

1-FOR SENSITIVITY OF YIELD AND TERMINAL VALUES TO TERM.

2-FOR SENSITIVITY TO YIELD SPREAD

3-FOR SENSITIVITY TO YIELDS

4-FOR YIELDS AND TERMINAL VALUES AT YOUR TERM. DATE

WHICH TABLE DO YOU WANT ? 1

This BASIC program computes the before- and after-tax yield to maturity of a bond given the annual coupon, the redemption value, the maturity, and the price. The user specifies tax rates for interest receipts (T1) and capital gains (T2). Premium on purchase is amortized over the maturity and deducted at rate T1. Discount at purchase is taxed at maturity at rate T2.

This is a more complex program than BONDPR, because it calculates not only a yield to maturity, but also a yield to maturity after income tax. In addition to the annual coupon payment, the amounts to be received at redemption, the maturity, and the current price of the bond, the user must furnish two tax rates. The first tax rate, T1, will be applied to receipts of interest payments. This rate will generally be the investor's ordinary income tax rate except where the bond is tax-exempt in which case this rate will be zero. The second tax rate, T2, is the capital gain rate. The computer will apply this tax rate at maturity to the amount by which the redemption proceeds exceed the purchase price of the bond. For an individual purchaser, the capital gain rate will normally be half the ordinary tax rate, with a maximum of 25%. For a corporate purchaser, the rate will normally be 25%.

For tax purposes, any premium at purchase above the amount to be received at redemption is amortized over the maturity of the bond, and the amortization reduces taxes at the rate T1.

INSTRUCTIONS

The program inquires about the method of entering data as follows:

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA?

There are three options:

1. If you answer YES, the program will print out a description of each line of data to be entered; enter the data one line at a time.
2. If you answer NO, the program will ask for the data to be entered in lines one through five; enter the data, separated by commas, on one line.
3. If you answer DATA, the data already in the program will be printed out.

See the Sample Problem for examples of all three methods discussed above.

SAMPLE PROBLEM

Find the before- and after-tax yields, assuming a \$5 annual coupon, \$100 proceeds at redemption, a maturity of six years, 5-1/4 months, a price of \$97, and tax rates of 50% on interest receipts and 25% on capital gains.

SAMPLE SOLUTION

The three printouts illustrate the three methods available to the user of BONDYD. In the first the user requests instructions, while in the second data is entered on a line basis. The final example uses data already entered in the program.

Example 1* RUNDO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?YES

ENTER THE FOLLOWING DATA ITEMS

ITEM 1	ANNUAL COUPON (IN DOLLARS)	<u>?5</u>
ITEM 2	PROCEEDS ON REDEMPTION	<u>?100</u>
ITEMS 3 & 4	MATURITY IN YEARS, MONTHS	<u>?6,5.25</u>
ITEM 5	PRICE	<u>?97</u>
ITEMS 6 & 7	TAX RATES ON INCOME, CAP GNS	<u>? .5, .25</u>
COUPON	5 REDEMPTION AT	100 PRICE 97
MATURITY	6 YEARS	5.25 MONTHS
TAX RATES	.5 ON INCOME	.25 ON CAPITAL GAINS
YIELD BEFORE TAX	5.560054 PERCENT	
YIELD AFTER TAX	2.907394 PERCENT	

Example 2*RUNDO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?NENTER ITEMS 1 THROUGH 7 ?5,5.250000100,6,5.25,97,.5,.25ILLEGAL INPUT. RETYPE ?5,100,6,5.25,97,.5,.25

C0UP0N	5	REDEMPTION AT	100	PRICE	97
MATURITY	6 YEARS	5.25 MONTHS			
TAX RATES	.5 0N INCOME			.25 0N CAPITAL GAINS	

YIELD BEFORE TAX 5.560054 PERCENT

YIELD AFTER TAX 2.907394 PERCENT

Example 3*RUNDO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?DATA

C0UP0N	5	REDEMPTION AT	100	PRICE	97
MATURITY	6 YEARS	5.25 MONTHS			
TAX RATES	.5 0N INCOME			.25 0N CAPITAL GAINS	

YIELD BEFORE TAX 5.560054 PERCENT

YIELD AFTER TAX 2.907394 PERCENT

SAMPLE PROBLEM 2

Calculate the yield on a callable bond if the bond is called three years, 11-1/4 months in the future, at the call price (\$102.75 in this case), corresponding to that call date. Other variables are the same as those in the first sample problem.

SAMPLE SOLUTION 2

READY
*RUN

DO YOU WANT INSTRUCTIONS FOR ENTERING DATA ?YES

ENTER THE FOLLOWING DATA ITEMS

ITEM 1	ANNUAL COUPON (IN DOLLARS)	? <u>5</u>
ITEM 2	PROCEEDS ON REDEMPTION	? <u>102.75</u>
ITEMS 3 & 4	MATURITY IN YEARS, MONTHS	? <u>3,11.25</u>
ITEM 5	PRICE	? <u>97</u>
ITEMS 6 & 7	TAX RATES ON INCOME, CAP GNS	? <u>.5,.25</u>
COUPON	5	REDEMPTION AT 102.75
MATURITY	3 YEARS	11.25 MONTHS
TAX RATES	.5 ON INCOME	.25 ON CAPITAL GAINS
YIELD BEFORE TAX	6.498593 PERCENT	
YIELD AFTER TAX	3.637365 PERCENT	

This BASIC program takes historical data of monthly revenues and expenses and predicts the next year's cash flow requirements. This problem is slanted to a municipality or state government, but the user may adjust names and expense and revenue accounts to cover any situation.

INSTRUCTIONS

To use program:

1. Delete sample data in lines 100-400 (DELETE 100, 400).
2. Type data in lines 100-1000 in this manner:
 - a. First type in the number of revenue accounts; second, type the number of expense accounts; and third, type the number of years of data.
 - b. Next, type the name of the first revenue account, followed by its monthly data from the first year.
 - c. After this, type the monthly data for the second year through the last year.
 - d. After this account data has been entered, the other revenue accounts are typed, followed by the expense accounts.
 - e. The last data to be entered is the budget totals for each account for the coming year.
3. Now type RUN.

SAMPLE PROBLEM

Predict the next year's cash flow requirements based on the historical data already entered and illustrated as follows.

CASHFLOW-2

SAMPLE SOLUTION

READY

*LIST 99-400

99REM SAMPLE DATA

100 DATA 2,3,4

110 DATA TAXES

120 DATA 22.4,29.13,35.10,42.3,48.29,57.48,66.30,72.25,77.1,84.40

130 DATA 91.17,96.23

140 DATA 24.09,30.23,38.12,45.82,55.12,62.96,68.87,74.57,80.9

150 DATA 92.13,101.93,109.67

160 DATA 24.50,33.42,41.86,52.15,59.23,69.98,78.32,89.75,95.69

170 DATA 106.42,114.35,124.7

180 DATA 25.22,35.19,46.17,57.47,68.67,76.34,85.72,96.24,108.95

190 DATA 117.38,126.56,138.40

200 DATA LICENCES

210 DATA 5.3,6.2,7.2,6.9,5.6,4.2,3.1,2.9,3.4,5.3,2.1,1.8

220 DATA 2.9,7.4,8.1,7.2,6.1,5.6,4.2,2.9,3.3,5.5,2.3,1.9

230 DATA 4.8,8.2,9.0,7.8,6.7,5.9,5.1,3.3,3.7,5.4,2.7,1.8

240 DATA 5.0,7.9,9.2,8.3,7.2,6.4,5.3,3.7,4.1,5.2,2.8,1.7

250 DATA PAYROLL

260 DATA 55,55,55,55,55,55,55,55,55,55,56,57,57

270 DATA 61,62,62,62,62,62,62,62,56,56,56,63

280 DATA 69,69,69,69,69,69,69,70,70,70,70,70

290 DATA 77,77,77,77,77,79,79,79,79,79,79,79

300 DATA WELFARE

310 DATA 7.28,6.29,5.37,5.42,3.56,3.56,3.68,3.98,4.45,6.37,6.98,7.10

320 DATA 7.33,6.32,5.27,5.40,3.60,3.60,3.60,3.87,4.87,6.42,6.95,7.03

330 DATA 6.27,6.33,5.22,5.37,3.41,3.43,3.41,3.59,4.43,6.07,6.16,6.83

340 DATA 5.98,6.07,5.25,5.23,4.21,3.45,3.37,3.37,3.99,5.86,5.75,6.08

350 DATA HIGHWAY

360 DATA 4.2,4.1,3.8,3.8,4.0,4.8,4.41,4.7,4.08,2.9,2.8,3.5

370 DATA 4.1,4.3,3.9,3.7,4.2,4.9,4.95,4.95,4.35,3.3,3.2,3.7

380 DATA 4.3,4.2,3.85,3.9,4.5,5.0,5.1,4.9,4.8,3.4,3.4,4.1

390 DATA 4.4,4.2,3.9,4.1,4.6,5.2,5.3,5.1,4.1,3.7,3.7,4.2

400 DATA 1080,68,1030,60,58

READY

*RUN

FORECASTED INCOME STATEMENT

	JAN	FEB	MAR	APR	MAY	JUN
REV ACCTS						
TAXES	28.45	39.25	50.87	63.20	74.78	84.27
LICENCES	5.03	8.19	9.40	8.42	7.27	6.45
TOTAL REVENUES	33.48	47.44	60.27	71.62	82.05	90.72
EXP ACCTS						
PAYROLL	84.80	84.87	84.87	84.87	84.87	86.51
WELFARE	6.18	6.21	5.31	5.33	4.08	3.50
HIGHWAY	4.86	4.68	4.33	4.50	5.07	5.73
TOTAL EXPENSES	95.84	95.76	94.51	94.70	94.02	95.74
NET SURP(DEF)	-62.36	-48.32	-34.24	-23.08	-11.97	-5.02
CUM SURP(DEF)	-62.36	-110.68	-144.92	-168.00	-179.97	-184.99

CASHFLOW-4

	JUL	AUG	SEP	OCT	NOV	DEC
REV ACCTS						
TAXES	94.49	106.27	118.62	128.91	139.08	151.81
LICENCES	5.35	3.70	4.11	5.45	2.84	1.80
TOTAL REVENUES	99.84	109.97	122.73	134.36	141.92	153.61
EXP ACCTS						
PAYROLL	86.51	86.74	86.35	86.37	86.39	86.86
WELFARE	3.43	3.48	4.17	6.00	5.97	6.35
HIGHWAY	5.83	5.62	4.73	4.02	4.01	4.62
TOTAL EXPENSES	95.77	95.84	95.25	96.39	96.37	97.83
NET SURP(DEF)	4.07	14.13	27.48	37.97	45.55	55.78
CUM SURP(DEF)	-180.92	-166.79	-139.31	-101.34	-55.79	.00

This BASIC program calculates monthly or annual depreciation by straight-line, double-declining balance, sum-of-the-years-digits, and 150% declining balance.

INSTRUCTIONS

Enter data as requested by the program.

SAMPLE PROBLEM

Calculate the depreciation of a machine costing \$2,100 and having a salvage value of \$100 after ten years. Use a discount rate of 5%.

SAMPLE SOLUTION

THIS PROGRAM COMPUTES AND PRINTS DEPRECIATION BY MONTHS BY STRAIGHT LINE, DOUBLE DECLINING BALANCE, SUM-THE-YEARS-DIGITS, AND 150 PERCENT DECLINING BALANCE.

IF YOU WISH TO SUPPRESS MONTH BY MONTH DETAIL, TYPE '1' AFTER QUESTION MARK. OTHERWISE, TYPE '0'. ?1

WHAT IS THE AMOUNT OF THE INVESTMENT ?2100

WHAT IS THE SALVAGE VALUE ?100

WHAT IS THE DEPRECIABLE LIFE (IN YEARS) ?10

AT THE END OF WHICH MONTH (1 THRU 12), AND IN WHAT YEAR (EG. 1968) IS THE INVESTMENT MADE ?12, 1969

WHAT IS THE DISCOUNT RATE (IN DECIMAL NOTATION) FOR COMPUTING THE PRESENT VALUE OF THE ANNUAL DEPRECIATION ?.05

YOU HAVE OPTIONS ON SWITCHOVER FROM DOUBLE DECLINING BALANCE TO STRAIGHT LINE. TO PREVENT SWITCHOVER TYPE 0; TO SPECIFY THE YEAR OF SWITCHOVER, TYPE THE YEAR; TO OBTAIN AUTOMATIC SWITCHOVER WHEN THE ANNUAL STRAIGHT LINE DEPRECIATION BECOMES GREATER THAN DOUBLE DECLINING BALANCE, TYPE 1. WHICH DO YOU WANT ?0

DEPREC-2

DATE	STRLINE	DDB	SYD	150\DB
1969	0	0	0	0
CUM DEP	0	0	0	0
UNDEPR BAL	2000	2000	2000	2000
1970	200	420	363.6364	315
CUM DEP	200	420	363.6364	315
UNDEPR BAL	1800	1580	1636.364	1685
1971	200	336	327.2727	267.75
CUM DEP	400	756	690.909	582.75
UNDEPR BAL	1600	1244	1309.091	1417.25
1972	200	268.8	290.9091	227.5875
CUM DEP	599.9999	1024.8	981.8181	810.3374
UNDEPR BAL	1400	975.2001	1018.182	1189.663
1973	200	215.04	254.5455	193.4494
CUM DEP	799.9999	1239.84	1236.363	1003.787
UNDEPR BAL	1200	760.1601	763.6365	996.2132
1974	200	172.032	218.1819	164.432
CUM DEP	999.9999	1411.872	1454.545	1168.219
UNDEPR BAL	1000	588.1281	545.4548	831.7814
1975	200	137.6256	181.8183	139.7672
CUM DEP	1200	1549.497	1636.363	1307.986
UNDEPR BAL	800.0002	450.5026	363.6366	692.0142
1976	200	110.1005	145.4546	118.8021
CUM DEP	1400	1659.598	1781.818	1426.788
UNDEPR BAL	600.0004	340.4022	218.182	573.2121
1977	200	88.08044	109.091	100.9818
CUM DEP	1600	1747.678	1890.909	1527.77
UNDEPR BAL	400.0005	252.3219	109.0911	472.2303
1978	200	70.46437	72.72738	85.83455
CUM DEP	1799.999	1818.142	1963.636	1613.604
UNDEPR BAL	200.0006	181.8576	36.36377	386.3958
1979	200.0006	56.37151	36.36377	72.95937
CUM DEP	1999.999	1874.514	2000	1686.563
UNDEPR BAL	0	125.4862	0	313.4365
PRESENT VALUE OF DEPRECIATION				
AT THE BEGINNING OF 1969				
Σ S Z	1470.807	1494.531	1578.019	1318.704

This BASIC program calculates the monthly payments schedule for an installment loan and prints it in ledger format. The program determines the monthly payment to be made by the borrower and prorates it among three uses: principal repayment, insurance expense reimbursement, and interest payment. Interest and insurance are amortized over the life of the loan according to the sum-of-the-months digits method. The residual of the monthly payment is then used for principal repayment.

INSTRUCTIONS

Sample data is entered in lines 1090 and 1100. To use the program, remove sample data (DELETE 1090, 1100) and enter new data in this format:

*1090, Name, Street, City

*1100 Beginning month, beginning day, beginning year, loan amount, insurance amount, interest rate, effective rate, month to maturity.

SAMPLE PROBLEM

Calculate the monthly payments schedule of a 12-month loan of \$2500 beginning on July 1, 1972, at an interest rate of 6%, an effective interest rate of 11%. The insurance costs \$31.91.

SAMPLE SOLUTION

* RUN

INSTALLMENT LOAN LEDGER

JAMES JONES
100 CACTUS AVE.
PHOENIX, ARIZ.

AMOUNT OF LOAN	2500.00
INTEREST	152.01
INSURANCE	31.91

FACE AMOUNT OF THE NOTE	2683.92

ADD ON INTEREST RATE .06
EFFECTIVE RATE .11
DATE OF LOAN IS JULY 1, 1972
MONTHS TO MATURITY 12
MONTHLY PAYMENT \$ 223.66

INSTLO-2

DATE DUE -----	DATE PAID -----	BALANCE REMAIN -----	PAYOFF BALANCE -----	IRREG PAYMENT -----	NEW OR SHORT -----	UNEARN INSURE -----	REMAINING INTEREST -----	EARNED INTEREST -----
1972								
JULY	NONE	2683.92	2500.00			31.91	152.01	
AUG		2460.26	2304.64			27.00	128.62	23.39
SEPT		2236.60	2106.92			22.50	107.18	21.44
OCT		2012.94	1906.84			18.41	87.69	19.49
NOV		1789.28	1704.40			14.73	70.15	17.54
DEC		1565.62	1499.60			11.46	54.56	15.59
1973								
JAN		1341.96	1292.44			8.60	40.92	13.64
FEB		1118.30	1082.92			6.15	29.23	11.69
MAR		894.64	871.05			4.10	19.49	9.74
APR		670.98	656.83			2.46	11.69	7.80
MAY		447.32	440.25			1.23	5.84	5.85
JUNE		223.66	221.31			0.41	1.94	3.90
JULY		0.00	0.00			0.00	0.00	1.94

TOTAL INTEREST PAID IN 1972 IS 97.45

TOTAL INTEREST PAID IN 1973 IS 54.57

This BASIC program calculates the effective interest rate compounded over any desired period. Included is the option to compound over the shortest period between payments, a compliance required of Regulation Z (Truth in Lending) of the Federal Reserve System.

METHOD

The user need only type RUN to use the program. All the necessary data is input while the program is running. However, the program method is best illustrated in the following example.

A lender is negotiating a customer loan for \$5000. The customer requests repayment be made over a 72-week period, paying \$100 on the 15th of each month, and \$200 on the 30th of each month for the next 15 months, followed by a final payment of \$1000 at the end of 13 months (3 months after the last \$200 payment). However, the lender offers a repayment plan of \$150 every 15 days for the next 38 months, according to standard loan policy.

In order to check the compound interest rates of the alternatives, INTRSTZ is run. Initial input is the loan amount, \$5000, and the shortest period between payments of HALF MONTH. Next input is the payments schedule, \$200 for the 2nd, 4th, etc., through the 29th period, and \$1000 for the 36th period. Note that a 0 is the final entry, which signals the end of the payments schedule. This 0 must be in the last line of the entries.

The compounding period for this loan is semimonthly, and a complete printout of the schedule of payments is requested. The program provides the schedule of payments, the interest rate compounded annually, the interest rate compounded over the period specified (semimonthly, for example), and the excess of payments over the loan amount.

SAMPLE RUN

```
SYSTEM ?BASIC
ØLD ØR NEW-ØLD INTRSTZ
READY
*RUN
```

INTRSTZ-2

1. AMOUNT OF LOAN

?50002. SHORTEST PERIOD BETWEEN PAYMENTS
(DAY, WEEK, HALF MONTH, MONTH, QUARTER,
HALF YEAR, YEAR)?HALF MONTH3. AMOUNT OF PAYMENT AND PERIOD(S) OF PAYMENT
(E.G. 100,1,2,3,4,5,6)
INPUT 0 AFTER ALL PAYMENTS HAVE BEEN ENTERED

?200,2,4,6,8,10
?200,12,14,16,18
?200,20,22,24
?200,26,28,30
?100,1,3,5,7,9,11
?100,13,15,17,19
?100,21,23,25,27
?100,29
?1000,36
?0

4. COMPOUNDING PERIOD
(DAILY, WEEKLY, SEMIMONTHLY, MONTHLY,
QUARTERLY, SEMIANNUALLY, ANNUALLY,
TIME TO PAYMENT)?SEMIMONTHLY5. WOULD YOU LIKE TO HAVE
THE SCHEDULE OF PAYMENTS PRINTED?YES

PAYMENT NUMBER	PAYMENT AMOUNT	END OF HALF MONTH
1	200.00	2
2	200.00	4
3	200.00	6
4	200.00	8
5	200.00	10
6	200.00	12
7	200.00	14
8	200.00	16
9	200.00	18
10	200.00	20
11	200.00	22
12	200.00	24
13	200.00	26
14	200.00	28
15	200.00	30

16	100.00	1
17	100.00	3
18	100.00	5
19	100.00	7
20	100.00	9
21	100.00	11
22	100.00	13
23	100.00	15
24	100.00	17
25	100.00	19
26	100.00	21
27	100.00	23
28	100.00	25
29	100.00	27
30	100.00	29
31	1000.00	36

ANNUAL INTEREST RATE COMPOUNDED ANNUALLY = 12.9 %

ANNUAL INTEREST RATE COMPOUNDED SEMIMONTHLY = 12.2 %

THE EXCESS OF PAYMENTS OVER LOAN AMOUNT IS \$500.00

Since the lender also wants to compute the interest rates for the alternate repayment schedule, YES is the reply to the program question: WOULD YOU LIKE TO CHANGE SOME OF THE INPUT DATA. Only payments schedule is changed, so a 3 is entered indicating such. Then the payments schedule of \$150 for the 36 semimonthly payments is entered, and a 0 to signal the end of the schedule. The program provides the same output as for the first repayment alternative, but the schedule of payments printout is suppressed. The alternate calls for a lower interest rate.

WOULD YOU LIKE TO CHANGE SOME OF THE INPUT DATA ?YES

WOULD YOU LIKE TO CHANGE

1. AMOUNT
2. PERIOD BETWEEN PAYMENTS
3. PAYMENTS SCHEDULE
4. COMPOUNDING PERIOD
5. AMOUNT & PAYMENTS SCHEDULE
6. ALL OF THE INPUT DATA

ENTER 1,2,3,4,5 OR 6

?3

INTRSTZ-4

3. AMOUNT OF PAYMENT AND PERIOD(S) OF PAYMENT
(E.G. 100,1,2,3,4,5,6)

INPUT 0 AFTER ALL PAYMENTS HAVE BEEN ENTERED

YES

ENTER 1,2,3,4,5 OR 6

?150,1,2,4,5,6
?150,7,8,9,10,11,12
?150,13,14,15,16,17
?18,19,20,21,22,23

?3

3. AMOUNT OF PAYMENT AND PERIOD(S) OF PAYMENT
(E.G. 100,1,2,3,4,5,6)

INPUT 0 AFTER ALL PAYMENTS HAVE BEEN ENTERED

?150,1,2,3,4,5,6,7
?150,8,9,10,11,12,13
?150,14,15,16,17,18
?150,19,20,21,22,23,24
?150,25,26,27,28,29,30
?150,31,32,33,34,35,35
?0

5. WOULD YOU LIKE TO HAVE
THE SCHEDULE OF PAYMENTS PRINTED

?NO

ANNUAL INTEREST RATE COMPOUNDED ANNUALLY = 10.8 %

ANNUAL INTEREST RATE COMPOUNDED SEMIMONTHLY = 10.3 %

THE EXCESS OF PAYMENTS OVER LOAN AMOUNT IS \$400.00

WOULD YOU LIKE TO CHANGE SOME OF THE INPUT DATA ?NO

INVANL, a business program written in FORTRAN, analyzes return-on-investment by computing a payback period and a discounted rate of return for a series of cash flows resulting from capital expenditures. The program follows a standardized procedure and can be particularly useful in making capital appropriation requests for machinery, equipment, computers, etc.

Specifically, INVANL is useful in determining profitability and economic justification for investments. There are two parts to the program: cash flow analysis and return-on-investment analysis. The objective of cash flow analysis is to compute the yearly cash flow resulting from the investment and to determine its payback period. The objective of the return-on-investment analysis is to compute the average annual rate of return from the investment based on a discounted cash flow method.

INSTRUCTIONS

The program asks the user to enter the data. Input data includes:

Net Initial Investment — initial cost in dollars of requested investment. The expenditure is made at some point in time called year zero. All other income and outlays begin in year one. Enter investment as minus dollars.

Weighted Cost of Capital — average cost or charge for obtaining investment capital. The percentage figure represents an average cost of the source of funds, weighted by the company debt/equity ratio.

Project Life — the number of years for which you are analyzing cash flows. Project life may represent depreciable life, lease agreement or an unspecified length of time. Year zero merely represents the point in time at which you make the investment. The next day is the first day of year one (no income can be credited to year zero). The program is designed to handle flows for up to 100 years.

Outlays — yearly investment or rental expenditure as part of total capital investment (excludes operating expenses). All outlays and expenditures must be entered as minus numbers. If no outlay is made, enter zero for the year.

Income — yearly operating savings or earnings (losses) before interest and depreciation charges. Losses should be entered as minus dollars.

Cash Flow Analysis

- A = year
- B = opening balance = closing balance from previous year
- C = investment or rental outlay
- D = operating income or savings
- E = average net investment for year
- F = cost of capital = X% of E (X is percentage rate)
- G = closing balance = B+C+D+F

Cost of capital charges are subtracted from income to obtain a net cash flow figure (income-outlay-interest). A payback period is then determined by crossover of net cash flow from negative to positive. After payback, the cost of capital figures are added to income on the assumption that earnings are reinvested at a rate at least equal to the cost of capital.

Discounted Rate of Return

Present Value Equation: present value of cash flows = $R/(1+i)^x$

Cumulative P. V. of Cash Flows = $\sum R_0/(1+i)^1 + \dots R_n/(1+i)^n$

where

- R is operating cash flow (income-outlay)
- i is some interest rate (the discounted rate of return is that interest rate which equates the present value of future returns to the present investment outlay)
- n is project life in years
- x is a given year in project life investment

The discounted rate of return can be compared with the cost of capital to determine the profitability of the investment and with desired rates of return for purposes of ranking investments. At the end of the report a choice is provided:

- If 1 is typed, it is possible to change selected years outlay/income for the same investment and/or cost of capital or project life (see second printout).
- If 2 is typed, it is possible to analyze a whole new capital investment (i.e., a new project may be entered).
- If 3 is typed, it will end the run.

All dollar figures must be entered as whole numbers, with no commas or decimals. All outlays and losses should be negative numbers. The cost of capital may be carried to two decimal places. The project life must be a whole number between 1 and 100. If there is no outlay for a year, type 0. Hit the RETURN key (carriage return) after each line of input.

SAMPLE PROBLEM

Analyze the return on a net initial investment of \$1 million over five years when the weighted cost of capital is 8.0%. Outlay and income are as indicated in the Sample Solution.

SAMPLE SOLUTION*RUN=(CORE=20K)

DO YOU WANT DESCRIPTION OF ROI PROGRAM? 1=YES 2=NO

=1

THIS PROGRAM CALCULATES THE DISCOUNTED RATE OF RETURN WHICH EQUATES THE PRESENT VALUE OF THE OPERATING CASH FLOW TO ZERO. A PAYBACK PERIOD IS ALSO COMPUTED, BASED ON NET CASH FLOW. INTEREST IS COMPUTED ON THE AVERAGE BALANCE FOR THE YEAR. THE PROGRAM OFFERS SENSITIVITY ANALYSIS BY ALLOWING THE USER TO CHANGE SELECTED FIGURES FOR THE SAME CAPITAL INVESTMENT.

ENTER INPUT DATA:

NET INITIAL INVESTMENT IN DOLLARS ONLY(EG. -5000)

=-1000000

WEIGHTED COST OF CAPITAL IN % (EG. 8.0)

=8.0

PROJECT LIFE IN YEARS

=5

OUTLAY, INCOME(SEPARATE BY COMMA;MINUS FOR OUTLAY)

INPUT IN DOLLARS ONLY(E.G. -1000,3000)

YEAR 1

=-500000,300000

YEAR 2

=-100000,700000

YEAR 3

=0,1000000

YEAR 4

=0,1000000

YEAR 5

=0,1000000

INVANL-4

INPUT DATA SUMMARY

YEAR	OUTLAY O	INCOME I	INTEREST X
0	-1000000.00	0.	0.
1	-500000.00	300000.00	-88000.00
2	-100000.00	700000.00	-79040.00
3	0.	1000000.00	-21363.20
4	0.	1000000.00	56927.74
5	0.	1000000.00	141481.96

IS DATA CORRECT 1=YES 2=NO
=1

YEAR	NET CASH FLOW O+I+X	CUMULATIVE FLOW END OF PERIOD
0	-1000000.00	-1000000.00
1	-288000.00	-1288000.00
2	520960.00	-767040.00
3	978636.80	211596.80
4	1056927.75	1268524.55
5	1141481.97	2410006.53

PAYBACK OF INI. INV. IS 2 YEARS 10 MONTHS

YEAR	OPERATING CASH FLOW O+I	PRESENT VALUE OF OPERATING CASH FLOW
1	-200000.00	-143900.29
2	600000.00	310609.38
3	1000000.00	372473.16
4	1000000.00	267994.97
5	1000000.00	192822.77

CUMULATIVE PRESENT VALUE OF CASH FLOWS 1000000.00

RATE OF RETURN EQUATING P.V. OF FLOW TO ZERO IS 38.99 %

ENTER 1,2,OR 3: 1=CHANGE SELECTED DATA, 2=CHANGE ALL DATA, 3=STOP.
=3

Assuming the results of the previous run are unsatisfactory, typing 1 allows changes to be made. In the following example, the same investment is changed to six years, different data is entered for year 2, and additional data is entered for year 6. Note the period after each income figure.

*

ENTER 1,2,OR 3: 1=CHANGE SELECTED DATA, 2=CHANGE ALL DATA, 3=STOP.

=1

ENTER INPUT DATA:

NET INITIAL INVESTMENT IN DOLLARS ONLY(EG. -5000)

=-1000000

WEIGHTED COST OF CAPITAL IN % (EG. 8.0)

=8.0

PROJECT LIFE IN YEARS

=6

TO CHANGE DATA, TYPE YEAR COMMA OUTLAY COMMA INCOME

PERIOD THEN CR

MINUS FOR OUTLAY; PERIOD MUST APPEAR(EG. 4,-1000,5000.)

TO STOP TYPE 'END' THEN CR

=2,-200000,600000.

=6,0,500000.

=END

INPUT DATA SUMMARY

YEAR	OUTLAY Q	INCOME I	INTEREST X
0	-1000000.00	0.	0.
1	-500000.00	300000.00	-88000.00
2	-200000.00	600000.00	-87040.00
3	0.	1000000.00	-38003.20
4	0.	1000000.00	38956.54
5	0.	1000000.00	122073.07
6	0.	500000.00	191838.91

IS DATA CORRECT 1=YES 2=NO

=1

INVANL-6

YEAR	NET CASH FLOW 0+I+X	CUMULATIVE FLOW END OF PERIOD
0	-1000000.00	-1000000.00
1	-288000.00	-1288000.00
2	312960.00	-975040.00
3	961996.80	-13043.20
4	1038956.55	1025913.34
5	1122073.06	2147986.41
6	691838.91	2839825.31

PAYBACK OF INI. INV. IS 3 YEARS 1 MONTHS

YEAR	OPERATING CASH FLOW 0+I	PRESENT VALUE OF OPERATING CASH FLOW
1	-200000.00	-145163.56
2	400000.00	210724.59
3	1000000.00	382369.13
4	1000000.00	277530.32
5	1000000.00	201436.44
6	500000.00	73103.08

CUMULATIVE PRESENT VALUE OF CASH FLOWS 1000000.00

RATE OF RETURN EQUATING P.V. OF FLOW TO ZERO IS 37.78 %

ENTER 1,2,OR 3: 1=CHANGE SELECTED DATA, 2=CHANGE ALL DATA, 3=STOP.
=1

Assume the cost of capital has been increased to 10.0% and the project life decreased to five years (see example below). In addition, changed data is submitted for year 2 and year 6.

By typing 1 at this point, the investor can handle these assumptions. Since the life has been set for five years, the data for year 6 is ignored and the warning message PROGRAM IS DESIGNED FOR AT LEAST ONE YEAR is printed. In this instance, the program still continues processing after END is typed.

ENTER INPUT DATA:
 NET INITIAL INVESTMENT IN DOLLARS ONLY(EG. -5000)
 =-1000000
 WEIGHTED COST OF CAPITAL IN % (EG. 8.0)
 =10.0
 PROJECT LIFE IN YEARS
 =5
 TO CHANGE DATA, TYPE YEAR COMMA OUTLAY COMMA INCOME
 PERIOD THEN CR
 MINUS FOR OUTLAY; PERIOD MUST APPEAR(EG. 4, -1000, 5000.)
 TO STOP TYPE 'END' THEN CR
 =2, -200000, 650000.
 =6, 0, 500000.
 PROGRAM DESIGNED FOR AT LEAST 1 YEAR, TRY AGAIN!
 =END
 INPUT DATA SUMMARY

YEAR	OUTLAY Ø	INCOME I	INTEREST X
0	-1000000.00	0.	0.
1	-500000.00	300000.00	-110000.00
2	-200000.00	650000.00	-108500.00
3	0.	1000000.00	-46850.00
4	0.	1000000.00	48465.00
5	0.	1000000.00	153311.50

IS DATA CORRECT 1=YES 2=NO

=

The program informs the investor if the cumulative flow for the last period is negative by printing the statement OUTLAY EXCEEDS INCOME BY (e.g., - 500.00). If outlays exceed income, then the rate of return is zero.

ENTER 1, 2, OR 3: 1=CHANGE SELECTED DATA, 2=CHANGE ALL DATA, 3=STOP.

=2

ENTER INPUT DATA:
 NET INITIAL INVESTMENT IN DOLLARS ONLY(EG. -5000)
 =-50000
 WEIGHTED COST OF CAPITAL IN % (EG. 8.0)
 =8.0
 PROJECT LIFE IN YEARS
 =3
 OUTLAY, INCOME(SEPARATE BY COMMA; MINUS FOR OUTLAY)
 INPUT IN DOLLARS ONLY(E.G. -1000, 3000)

INVANL-8

YEAR 1
=-10000,20000
YEAR 2
=0,20000
YEAR 3
=0,20000

INPUT DATA SUMMARY

YEAR	OUTLAY O	INCOME I	INTEREST X
0	-50000.00	0.	0.
1	-10000.00	20000.00	-3600.00
2	0.	20000.00	-2688.00
3	0.	20000.00	-1303.04

IS DATA CORRECT 1=YES 2=NO

=1

YEAR	NET CASH FLOW O+I+X	CUMULATIVE FLOW END OF PERIOD
0	-50000.00	-50000.00
1	6400.00	-43600.00
2	17312.00	-26288.00
3	18696.96	-7591.04

OUTLAY EXCEEDS INCOME BY -7591.04

ENTER 1,2,OR 3: 1=CHANGE SELECTED DATA, 2=CHANGE ALL DATA, 3=STOP.

=3

This BASIC program uses the Bower-Williamson¹ method of analysis to help the lessee make a lease/buy decision. LESSEE compares a lease with the alternative of borrowing the needed funds and purchasing the asset outright. The program assumes that if the asset is purchased it will be depreciated by the sum-of-the-years-digits method.

The Bower-Williamson method as used in LESSEE identifies and calculates two cost differences between owning and leasing. First, it calculates the financial advantage of the lease. This is simply the difference between the amount of debt capacity used up by the loan and that used up by the lease obligation. The financial advantage is measured by discounting the lease payments during the minimum time period of the lease (that is during the time the lessee cannot get out of the lease) at the interest rate the company would be charged on a loan, and subtracting this discounted present value from the amount that would have to be borrowed in order to purchase the asset. The Bower-Williamson method assumes that the obligations incurred in leasing use up borrowing power in the same way as loan obligations do.

Second, LESSEE calculates the discounted present value of the tax benefits associated with depreciation. This figure is clearly an advantage for ownership. To this is added the present value of all other cash flow advantages of the lease to get the operating advantage of the lease. In this calculation, the expense differences between leasing and owning in terms of the present value of the estimated salvage value of the property, and the difference in tax savings that results from the deductibility of rent payments in the case of the lease and of interest payments and property taxes when the asset is owned and financed with a loan, are included.

Beyond the minimum deviation of the lease, the rental obligation is assumed not to deplete borrowing capacity; the lease is treated as an operating lease, and the rent as an operating flow, so that during this period it enters into the operating advantage.

The cash flow difference between the lease and ownership cases is calculated for each year (the net balance in favor of the lease is designated the "basic cash flow saving with lease"), and the annual flows are discounted to give the final operating advantage of the lease.

¹ Bower, R. S., Herring, F. C., Williamson, P. J., "Lease Evaluation," The Accounting Review, April 1966;
Bower, R. S., Williamson, P. J., "Lease Negotiation Using a Timing Computer," Business Quarterly, Winter 1966;
Bower, R. S., Williamson, P. J., "Computer Analysis of the Banker's Lease Investment Opportunity," Banker's Magazine, Spring 1967.

LESSEE-2

The sum of the financial advantage and the operating advantage gives the net advantage of the lease. If this figure is positive, then the lease is financially more attractive than ownership. If it is negative, then ownership is financially more attractive.

INSTRUCTIONS

To calculate the cash flow differences between leasing and borrowing and to get net advantage, the user must enter values for the following variables in lines 120 to 123.

120 DATA P, T, R1, R2

where

- P is the purchase price of the equipment
- T is the lessee's income tax rate (as a decimal)
- R1 is the interest rate that would be paid on a loan, compounded semiannually (decimal)
- R2 is the opportunity rate that can be earned, after taxes, on new investment, compounded semiannually (decimal)

121 DATA M, L, S1, S2

where

- M is the monthly rent, payable in advance
- L is the depreciable life of the equipment, in years
- S1 is the salvage value for tax purposes in dollars
- S2 is expected actual salvage value; which must be less than P, the purchase price

122 DATA E1, E2, Y, J

where

- E1 is the expenses of making the lease agreement
- E2 is the annual saving in expenses due to the lease
- Y is the expected duration of the lease in years
- J is the minimum duration of the lease in years

123 DATA X, X1, X2

where

- X is the identification of the variable for which a sensitivity analysis is to be done; 0 if no analysis, 1 if no purchase price, 2 if income tax rate, 3 if interest rate, etc., through 8 if actual salvage value
- X1 is the lowest value for the variable specified in 13
- X2 is the highest value for the variable specified in 13

R1 is the interest rate applicable to a loan incurred to finance the purchase of the asset and comparable in quality to a lease obligation. R1 is an annual rate, compounded semi-annually and expressed as a decimal, e.g., .06.

R2 is the after tax rate of return the lessee is making on investments similar to the asset being considered, also expressed as a decimal.

J is the length of the minimum duration of the lease; it is the number of years which the lessee is obligated to rent the asset. Y, the expected length of the lease, contains the minimum period plus the length of any renewals expected. Neither the expected lease life nor the minimum rental period contains any assumption about the ability of the lessee to "buy his way out" of the lease with the payment of a penalty before the end of the minimum rental period.

X offers options of listing the cash flows and doing a sensitivity analysis, just as LESSOR does. The listing of the cash flows shows annually the rent, depreciation, loan interest, operating flow difference with the lease, the basic cash flow saving with the lease, and the basic cash flow discounted at the opportunity rate for each year. From these flows, LESSEE calculates the financial and operating advantage of the lease and sums them to yield the net advantage.

SAMPLE PROBLEM

Assume an asset costing \$60,000, where the lessee's tax rate is 48%, the interest rate on a loan would be 4-3/4%, and the lessee's opportunity rate is 10% after taxes. The asset can be leased for \$900 a month, the salvage claimed for tax purposes is \$5,000, and salvage actually expected is \$10,000. The expense of arranging a lease is \$1,000, and the annual saving in operating expenses due to leasing (rather than owning) the asset is \$3,500. The total life of the lease is expected to be 8 years, and the minimum commitment is 6 years. Call for a sensitivity analysis on depreciable life over a range of 8 to 18 years. Request an entire printout rather than just a sensitivity analysis.

SAMPLE SOLUTION

Type in the following:

```
*120 DATA 60000, .48, .0475, .1
*121 DATA 900, 10, 5000, 10000
*122 DATA 1000, 3500, 8, 6
*123 DATA 6, 8, 18
```

LESSEE-4

* RUN

DO YOU WANT THE SENSITIVITY ANALYSIS ONLY ? N0

COMPARISON OF LEASE WITH PURCHASE

PURCHASE PRICE \$ 60000 TAX RATE .48
 INTEREST RATE .0475 OPPORTUNITY RATE .1
 MONTHLY RENT 900 DEPRECIABLE LIFE 10 YEARS
 SALVAGE FOR TAX \$ 5000 EXPECTED SALVAGE \$ 10000
 EXPENSE OF ARRANGING LEASE \$ 1000
 ANNUAL EXPENSE SAVING DUE TO LEASE \$ 3500
 EXPECTED DURATION OF LEASE 8 YEARS
 MINIMUM DURATION OF LEASE 6 YEARS
 SENSITIVITY ANALYSIS ON DEPRECIABLE LIFE WITH A RANGE OF 8 TO 18

DO YOU WANT TO SEE THE FLOWS ? YES

YEAR	RENT	DEPREC'N	LOAN INTEREST	OP'G FLO DIFF'CE WITH LEASE	BASIC CASH FLO SAVING WITH LEASE	BASIC CASH FLOW DISC. AT .1
1	10800	10000	2588	2500	442	421
2	10800	9000	2162	3500	1646	1422
3	10800	8000	1715	3500	2341	1834
4	10800	7000	1247	3500	3045	2164
5	10800	6000	757	3500	3761	2424
6	10800	5000	243	3500	4487	2624
7	10800	4000	0	3500	-5716	-3031
8	10800	3000	0	-6500	-14276	-6867
TOTAL	86400	52000	8712	17000	-4270	991

FINANCIAL ADVANTAGE OF LEASE	\$3415.92
OPERATING ADVANTAGE OF LEASE	\$990.83
NET ADVANTAGE OF LEASE	\$4406.74

SENSITIVITY ANALYSIS ON DEPRECIABLE LIFE

DEPRECIABLE LIFE	NET ADVANTAGE OF LEASE
8	3387.12
9	3924.85
10	4406.74
11	4836.28
12	5219.10
13	5561.05
14	5867.54
15	6143.33
16	6392.49
17	6618.48
18	6824.26

This BASIC program calculates the rate of return the lessor receives for investing in an asset and then leasing it to someone else. Unlike LESSOR, this program recognizes that the rental payments from the lessee and the salvage value of the asset are uncertain. Business failure or financial stringency may cause the lessee to default or discontinue payments and may force the lessor to reclaim and sell the asset while taking his claim against the lessee to court. What the lessor will recover in these circumstances or what salvage will be, even without default, depends on chance. Using an estimate of the chance of default or discontinuance in any year and an estimate of the possible variation of actual salvage from expected salvage, this program simulates the experience a lessor might have with a lease contract. It generates a set of cash flows for the lessor letting the estimated chance factors determine whether there is a default, when the default occurs and what salvage will be. It calculates the lessor's rate of return on this set of cash flows. It repeats the process -- generating a new set of cash flows which varies from the first due to chance and which therefore, gives the lessor a different rate of return. This repetition continues. The 25, 50, or 100 trials of this lease investment that result (the user specifies the number of trials he wants) then provide an indication not only of the lessor's expected return but also of the possibility of substantial loss and the distribution of outcomes from which realized experience will be drawn.

INSTRUCTIONS

The user must enter values for the following variables in lines 120-122.

120 DATA P, L, C1, R1

where

1. P is investment
2. L is rent payment (L is 0 if the lease rate is given in item 4 below)
3. C1 is number of times per year that rent payments are made
4. R1 is lease rate, (R1 is 0 if the rent payment rather than the lease rate is given, otherwise, a decimal representation of an annual rate compounded C1 times a year)

121 DATA M, N1, S1, S2

where

- M is life of lease in years
- N1 is depreciable life of investment in years
- S1 is dollar amount of salvage claimed for tax purposes
- S2 is dollar amount of salvage actually expected

122 DATA T1, D, N2

where

- T1 is the lessor's tax rate (as a decimal)
- D is method of depreciation: 1 if straight line, 2 if double declining balance, and 3 if sum-of-the-years digits
- N2 is the number of trails that the user wants to have performed in the simulation.

The chance elements in the program are contained in lines 2280 to 2520, which are shown below and the user may change to fit the conditions with which he is dealing.

* LIST 2280

```

2280 LET M = 1
2290 LET U=RND(-1)
2300 IF M = N THEN 2330
2310 LET M = M + 1
2320 IF U > .005 THEN 2290
2330 LET U=RND(-1)
2340 IF U > .3 THEN 2370
2345REM          BANKRUPTCY
2350 LET Q=2
2360 GO TO 2380
2365REM          REORGANIZATION
2370 LET Q=6
2375REM          EXTRA SALVAGE VALUE
2380 LET Q=(P-S2)*.5+(.5*M)
2390 IF Q<N-M THEN 2430
2400 LET Q = N-M
2410 IF Q>0 THEN 2430
2420 LET Q = 0
2430 LET U=RND(-1)*.5
2440 LET S = (S2+Q+(P/10)*U)
2450 LET S = S + L*Q
2460 IF (N-M) = 0 THEN 2520
2470 LET K = L*(N-M)
2480 IF K>S THEN 2520
2490 LET S = K
2520 RETURN
2530 END

```

Lines 2280 and 2320 determine if there is a default and when it occurs. In this example, the figure .005 in line 2320 indicates that there is assumed to be a chance of 5 in 1000 that default will occur in any year after the first year. If there is a default, lines 2330 to 2370 establish whether it involves bankruptcy or reorganization. With bankruptcy, the court is taken to award a payment of two years' rent, with reorganization, six years' rent. The chance that default is associated with bankruptcy, rather than reorganization, is assumed here to be

three in ten and is established by the figure .3 in line 2340. The realized salvage or terminal recovery in the case of default is calculated in lines 2380 to 2490. For trials in which no default occurs, actual salvage is set equal to expected salvage plus or minus an amount which can range from -5 to 5% of the value of the original investment. For default, terminal recovery is the sum of the salvage just described, an additional salvage amount which is larger if default is earlier, the court award already determined, and an overall chance element.

LESSIM adds to LESSOR by helping the user consider the risk, as well as the return, that the lessor may find in a leasing arrangement.

SAMPLE PROBLEM

The figures in the data lines below constitute a sample problem. The 50 in line 122 calls for 50 simulations.

* 120 DATA 60000, 900, 12, 0
 * 121 DATA 8, 10, 0, 20000
 * 122 DATA .7, 3, 50

SAMPLE SOLUTION

READY

*RUN

SUMMARY OF INPUT DATA

INVESTMENT	60000	RENT PAYMENT	900
PAYMENTS	12 TIMES PER YR	LEASE LIFE	8
DEPRECIATION	50YD	DEPRECIABLE LIFE	10
TAX SALVAGE	0	ACTUAL SALVAGE	20000

RESULTS OF CALCULATION

LEASE RATE: 10.09938 PER CENT PER YEAR, COMPOUNDED 12 TIMES A YEAR

SUMMARY OF SIMULATION

LESSIM-4

NUMBER OF RUNS 50
AVERAGE RETURN PER RUN 5.538767 PER CENT
STANDARD DEVIATION OF RETURNS .2736524

SUMMARY OF RUNS IN WHICH A DEFAULT OCCURS

RUN	PERIOD	RETURN
28	36	5.434857
33	60	4.020228

SUMMARY OF THE 48 RUNS IN WHICH NO DEFAULT OCCURS

	NUMBER OF RUNS
5.26 < RETURN <= 5.31	*****
5.31 < RETURN <= 5.36	***
5.36 < RETURN <= 5.42	*
5.42 < RETURN <= 5.47	****
5.47 < RETURN <= 5.52	*****
5.52 < RETURN <= 5.58	*****
5.58 < RETURN <= 5.63	*
5.63 < RETURN <= 5.68	*****
5.68 < RETURN <= 5.74	*****
5.74 < RETURN <= 5.79	*****

MEAN = 5.45435
RANGE = 5.258627 - 5.788092
STD D = 1.34669

This BASIC program calculates the rate of return that the lessor receives for investing in an asset and then leasing it to someone else, i.e., the interest rate that discounts all of the net cash flows back to the initial investment the lessor must make.

By comparing the after-tax rate of return with the returns expected from alternative investments, the lessor can determine the desirability of the lease. The rate of return is calculated from the lessor's cash flows based on lease receipts and tax payments.

INSTRUCTIONS

To calculate cash flows and rate of return, the user must enter values for the following variables in lines 120-123.

120 DATA P, L, C1, R1

where

1. P is investment
2. L is rent payment (L is 0 if the lease rate is given in item 4 below, rather than the rent payment)
3. C1 is number of times per year that rent payments are made
4. R1 is lease rate (R1 is 0 if the rent payment rather than the lease rate is given, otherwise a decimal representation of an annual rate compounded C1 times a year)

121 DATA M, N1, S1, S2

where

- M is life of lease in years
- N1 is depreciable life of investment in years
- S1 is dollar amount of salvage claimed for tax purposes
- S2 is dollar amount of salvage actually expected

122 DATA T1, D

where

- T1 is the lessor's tax rate (as a decimal)
- D is method of depreciation (D is 1 if straight line, 2 if double declining balance, and 3 if sum-of-the-years digits)

123 DATA Tn, R8, R9

where

- Tn is identification of the variable for which a sensitivity analysis is to be done (0 for no analysis, 1 if investment, 2 if rent payment, 3 if lease life, 4 if lease rate, 5 if depreciable life, 6 if tax salvage, or 7 if actual salvage)
- R8 is the lowest value for the variable specified in 11
- R9 is the highest value for the variable specified in 11

By typing YES to the question DO YOU WANT TO SEE THE FLOWS?, the user receives a list of the flows generated from inputs. This list includes each year's depreciation, rent receipt, tax payment, and cash flow. The cash flow is the difference between the rent receipt and the tax payment. The rate of return is calculated from these cash flows.

By providing the appropriate information in data statements, the user determines the effect a change in a variable has on the calculated rate of return, i.e., the sensitivity of the rate of return to the variable in question.

SAMPLE PROBLEM

Assume a \$60,000 investment in an asset to be leased for \$900 a month (12 rent payments a year) on an 8-year lease with depreciation taken over 10 years, assuming \$5000 salvage is claimed for tax purposes and \$20,000 is actually expected as salvage value. The lessor's tax rate is 70%, and sum-of-the-years digits depreciation is to be used for tax purposes. Call for a sensitivity analysis on the salvage value actually realized at the end of the lease, over a range up to \$25,000.

Request the entire report, rather than simply a sensitivity analysis, given a summary of the data he supplied and a rate of return on the lease of 5.2% per year compounded monthly.

SAMPLE SOLUTION

* 120 DATA 60000, 900, 12, 0
* 121 DATA 8, 10, 5000, 20000
* 122 DATA .7, 3
* 123 DATA 7, 0, 25000

READY

*RUNDO YOU WANT THE SENSITIVITY ANALYSIS ONLY ?N0

SUMMARY OF INPUT DATA

INVESTMENT	60000	RENT PAYMENT	900
PAYMENTS	12 TIMES YEARLY	LIFE OF LEASE	8
DEPRECIATION	50YD	DEPRECIABLE LIFE	10
TAX SALVAGE	5000	ACTUAL SALVAGE	20000
LESSOR'S TAX RATE	.7		

SENSITIVITY OF LEASE RATE AND LESSOR'S AFTER TAX RETURN TO
ACTUAL SALVAGE WILL BE ANALYZED WITH A RANGE OF 0 TO 25000 .

RESULTS OF CALCULATION

LEASE RATE: 10.09938 PER CENT PER YEAR, COMPOUNDED 12 TIMES YEARLY

LESSOR'S AFTER TAX RETURN: 5.233479 PER CENT PER YEAR COMPOUNDED
12 TIMES YEARLY

DO YOU WANT A LISTING OF THE FLOWS ?YES

LISTING OF CASH FLOWS

YEAR	LEASE RECEIPT	DEPRECIATION PAYMENT	TAX FLOW	CASH
0	-60000	0	0	- 60000
1	10800	10000	560.0001	10240
2	10800	8999.999	1260	9539.999
3	10800	8000	1960	8840
4	10800	7000	2660	8140
5	10800	6000	3360	7440
6	10800	5000	4060	6740
7	10800	4000	4760	6040
8	30800	10999.99	13860.01	16939.99
TOTAL	46400	59999.99	32480.01	13919.99

LESSOR-4

SENSITIVITY ANALYSIS ON ACTUAL SALVAGE

ACTUAL SALVAGE	LEASE RATE	LESSOR'S AFTER TAX RETURN
0	10.09938 %	3.276176 %
2500	10.09938 %	3.548423 %
5000	10.09938 %	3.796494 %
7500	10.09938 %	4.04511 %
10000	10.09938 %	4.294272 %
12500	10.09938 %	4.531465 %
15000	10.09938 %	4.769171 %
17500	10.09938 %	5.007373 %
20000	10.09938 %	5.233479 %
22500	10.09938 %	5.447453 %
25000	10.09938 %	5.661807 %

This BASIC program is designed to help a manufacturer decide whether to buy a certain component for a product, or make the component in the plant. The cost of buying the component is compared with the discounted stream of cash flows that would result if the necessary investments were made to produce the component.

INSTRUCTIONS

Type RUN to use this program, and it then asks for the method of data input (interactive or by line). After the question:

WOULD YOU LIKE INSTRUCTIONS FOR ENTERING DATA

type YES or NO, and enter the following data items:

1. The cost to buy a component F.O.B. your plant.
2. The cost to manufacture a component in your plant, including direct materials and labor, but not including overhead.
3. The initial investment (cost of the extra machinery that would be needed if you were going to manufacture the components).
4. The life of the investment in years.
5. The salvage value of this investment.
6. Method of depreciation to be used (sum-of-the-years-digits (1), straight line (2), or double declining balance (3)).
7. The annual fixed costs (such as supervision and maintenance) involved in your making the components.
8. Corporate tax rate in percent.
9. The local tax on the extra investment in dollars per thousand.
10. Cost of capital in percent.
11. Estimate of the yearly demand for the components.

SAMPLE PROBLEM

Perform a make/buy analysis where a component cost \$175 F.O.B. the plant, on \$175 to be manufactured in the plant, an initial investment of \$10,000 is needed, and the life of the investment is five years after which the salvage value will be \$2000. Straight line depreciation is used. The plant's annual fixed costs are \$12,000, the corporate tax rate is 25%, there is a local tax rate of \$5 per thousand, capital costs 12.5%, and the estimated yearly demand for the component is \$5000.

MAKE-BUY-2

SAMPLE SOLUTION

* RUN

WOULD YOU LIKE INSTRUCTIONS FOR ENTERING DATA(YES OR NO) ?NO

ENTER ITEMS 1 THROUGH 11

?175, 175, 10000, 5, 2000, 2, 12000, 25, 5, 12.5, 5000

THE PRESENT VALUE OF THE COST TO MAKE IS 3051346

THE PRESENT VALUE OF THE COST TO BUY IS 2992873

YOU SHOULD BUY THE COMPONENTS AT A SAVINGS OF \$58473

DO YOU WANT TO SEE THE CASH FLOWS ?YES

**** THE FLOWS ****

YEAR	IF BUY*****		IF MAKE*****		***NET***
	EXPENSE	CASH FLOW	EXPENSE	CASH FLOW	CASH FLOW
1	875000	656250	888634	664875	-8625
2	875000	656250	888626	664869	-8619
3	875000	656250	888618	664863	-8613
4	875000	656250	888610	664857	-8607
5	875000	656250	888602	663351	-7101

-----SENSITIVITY CHECK=====

WOULD YOU LIKE TO SEE THE EFFECT OF CHANGING

A VARIABLE (YES OR NO) ?NO

*-----SENSITIVITY CHECK=====

WOULD YOU LIKE TO SEE THE EFFECT OF CHANGING
 A VARIABLE (YES OR NO) ?YES
 WHAT IS THE NUMBER OF THE ITEM YOU WOULD LIKE
 TO CHANGE ?1
 WHAT IS THE NEW VALUE ?235
 WOULD YOU LIKE TO MAKE FURTHER CHANGES ?NO

THE PRESENT VALUE OF THE COST TO MAKE IS 3051346
 THE PRESENT VALUE OF THE COST TO BUY IS 4019001

YOU SHOULD MAKE THE COMPONENTS AT A SAVINGS OF \$967655

DO YOU WANT TO SEE THE CASH FLOWS ?YES

**** THE FLOWS ****

YEAR	IF BUY*****		IF MAKE*****		***NET***
	EXPENSE	CASH FLOW	EXPENSE	CASH FLOW	CASH FLOW
1	1175000	881250	888634	664875	216375
2	1175000	881250	888626	664869	216381
3	1175000	881250	888618	664863	216387
4	1175000	881250	888610	664857	216393
5	1175000	881250	888602	663351	217899

*-----SENSITIVITY CHECK=====

WOULD YOU LIKE TO SEE THE EFFECT OF CHANGING
 A VARIABLE (YES OR NO) ?NO

This FORTRAN program simulates the competitive interaction of companies. Decision choices with respect to product price, advertisement expenses, product development investments, etc., are used to calculate each company's share of a product market. The program outputs the asset status of each company at the end of each quarter of operation.

MGSIM-IN is an online instruction file.

METHOD, GENERAL INFORMATION AND USAGE

MGSIM¹ is a program for simulating a multifirm, one-product industry in which participants make top-level management decisions. The participants must be grouped into company teams having complete responsibility for its company's performance.

A team begins play by taking over the management of an existing company that has been operating in the marketplace for four quarters. Every company markets the same product in the industry. Each period of decision-making simulates one quarter of operations in the business world. For every quarter of operation each team makes decisions on the following items:

1. Price of the product
2. Production volume this quarter in units
3. Advertising expense
4. Research and development expense (R&D)
5. Investments in plant and equipment
6. Dividends paid

After the management decisions have been made for a quarter, they are entered into MGSIM. The decisions are input serially from a single console. If it is desired that each team's decision be confidential, someone not on the teams should be appointed to handle input and output.

MGSIM analyzes the decisions along with the history of previous quarters decisions. MGSIM then prints for each team a detailed performance report and financial statement. (These are described in the Sample Solution.)

¹ This management simulation game is based on a game originally conceived at U. C. L. A. and further refined by several other universities.

These reports are given to the teams. On the basis of this new information, the teams repeat the decision process and submit the next quarter's decisions. Usually, the simulation is run for six to eight quarters, but can be run up to a maximum of fifty quarters. It is also possible to save the history file so a simulation may be stopped and then continued at a later time.

Note that certain decisions are modified in the competitive environment to reflect the consistency of these decisions. All things being equal, relatively stable policies are more effective than policies with high fluctuations. For instance, suppose the price of a product was raised from \$6.00 to \$7.00 during a particular quarter. The reaction of customers in the market would be more pronounced than if the \$1.00 raise had taken place over three or four quarters.

Both advertising and R&D expenses have time lags that reflect a delayed reaction in the marketplace. While both advertising and R&D expenses take effect over several quarters of play, advertising impact is relatively intense and short-lived; however, R&D builds up value during increased investment at a slower rate and lingers longer when expenditures are cut back. Beyond a certain point, the incremental yield of R&D and advertising expenses becomes significant. The benefit from higher and higher expenses becomes increasingly less in an exponential fashion, so that at very high expenditures, the sales revenue gained does not compensate for the money spent.

The total sales of any company depends upon its own price, advertising, and R&D decisions, and upon all of its competitor's decisions for these three variables.

Some suggested criteria for corporate evaluation are given below:

1. Return on capital investment
2. Total equity and dividends
3. Profit
4. Production capacity
5. Percent share of industry sales
6. Growth rate of sales or profit

Companies are expected to select some combination of the above criteria as goals before they start playing. How well companies meet their goals will serve as the standards for evaluating company performance.

INSTRUCTIONS

MGSIM writes a history file so that the simulation may be continued at a later time. If a game is a continuation from an earlier run, the output history file from that run becomes

the input history file for the current run; another file must be provided for the new output history.

The output history file must be created prior to executing the program. It should also be accessed with alternate name "10" prior to execution. If the game is a continuation from an earlier run, the previously written history file should be accessed with alternate name 20. The program will ask questions such as the following:

QUARTER NUMBER	(enter 1 unless continuing an old game)
NUMBER OF FIRMS	(2 to 4)
INDUSTRY NUMBER	(1 to 32768)
COMPANY NUMBER	1, 2, 3, or 4
PRICE OF PRODUCT	(4.00 to 9.00)
PRODUCTION VOLUME (UNITS)	(200000 to 600000)
ADVERTISING EXPENSE	(100000 to 500000)
R&D EXPENSE	(0 to 500000)
INVESTMENT IN PLANT AND EQUIPMENT	(0 to 500000)
TOTAL DIVIDEND DECLARED	(0 to 500000)
COMPANY NUMBER	2
PRICE OF PRODUCT	6.75
ETC.	

After the last team's decisions have been entered, the program prints a performance report and financial statement for each company. The following is a complete outline and explanation of the progress report and financial statements.

Performance Indices

Sales Volume — The number of units sold in the current quarter.

Percent of Industry Sales — The ratio of company sales this quarter to total industry sales this quarter expressed as a percent.

Current Inventory Quantity — The number of unsold units remaining in inventory at the end of the quarter.

Production Capacity Next Quarter — The maximum number of units available for production next quarter (at approximately \$3.00 per unit). Production above this capacity limit incurs costs of approximately \$6.00 per unit.

Profit and Loss Statement

Income Sales Revenue — The volume of sales in units multiplied by the product price.

Manufacturing Costs — The variable cost of manufacturing products at the production volume indicated. Costs at or below production capacity are approximately \$3.00 per unit, while the costs above production capacity are approximately \$6.00 per unit. The actual cost is influenced by the amount of money previously spent for R&D.

Reduction in Inventory Value — The value of inventory from the previous quarter minus the value of inventory this quarter, both of which are valued on the Financial Condition Statement at the standard cost of \$3.00 per unit.

Research and Development Expense — A company decision each quarter.

Depreciation Expense — A noncash expense of 2.5% of production capacity each quarter (measured in dollars).

Advertising and Selling Expense — A company decision each quarter.

Miscellaneous Expenses — This includes four expense items:

1. Fixed costs of manufacturing — \$70,000 plus 18% of plant capacity (measured in dollars).
2. Inventory Carrying Costs — 25 cents for each unit of inventory unsold at the end of the quarter.
3. Plant Expansion Costs — The company decision to invest in Plant and Equipment incurs increased expansion costs exponentially, depending upon the amount of the decision.
4. Negative Net Cash Assets — Companies will be assessed an interest expense which increases exponentially with the magnitude of the cash borrowed to pay expense.

Administration Expense — \$200,000 plus 32% of plant capacity (measured in dollars).

Total Expenses — The sum of all operating expenses per quarter.

Profit Before Income Tax — Income from sales revenue minus the total operating expenses.

Addition to Income Tax Fund — The taxes paid at the rate of 48% per quarter.

Net Profit After Income Tax — The profit before taxes minus the tax paid.

Dividends Paid — A company decision.

Additions to Owners Equity — The net profit after income taxes minus the Dividends Paid.

Receipts and Disbursements Statement

Receipts - Sales Revenue — The number of units sold this quarter times the product price.

Cash Expenses — The sum of all expenses paid for in cash during the current quarter. This includes all operating expenses in the profit and loss statement except reduction in inventory value and depreciation.

Additions to Income Tax Fund — The tax expense of 48 percent of profit before income tax.

Dividends Paid — A company decision each quarter.

Investment in Plant and Equipment — The company decides each quarter to expand plant capacity. This includes the cash expense to compensate for depreciation losses and any new investment to increase plant capacity. (Plant capacity is increased at a cost of \$20 per unit.)

Total Disbursements — The sum of all cash expenses during the current quarter.

Net Addition to Cash Assets — Sales revenue minus total disbursements. This amount is added to net cash assets on the financial condition statement each quarter.

Financial Condition Statement

Net Cash Assets — The total cash on hand at the end of the quarter. Net cash assets this quarter is the sum of Net Cash Assets last quarter and Net Additions to Cash Assets, which is the residual account found on the Receipts and Disbursements Statement.

Inventory Value — The number of unsold units remaining in inventory at the end of the quarter times the standard cost of \$3.00 per unit.

Plant Net Book Value — The production capacity available for next quarter times the original cost of \$20 per unit of capacity. This is the residual of the loss in capacity due to depreciation plus the gain in capacity from Investment in Plant and Equipment.

Owners Equity — The total of all company assets.

After this report is printed, the game may be continued or discontinued.

RESTRICTIONS

MGSIM can handle up to four company teams. A maximum of fifty quarters can be played.

SAMPLE PROBLEM

Two teams play for two quarters. The two quarters will be run as separate executions of MGSIM. Before the program is executed, two history files are created using the ACCESS subsystem. Q1-HIST is the history file written for the first quarter and used as input for the second quarter. Q2-HIST is the history file written for the second quarter.

Before the first execution, the file Q1-HIST is accessed with the alternate name "10". Before the second execution, Q1-HIST is accessed with the alternate name "20" and Q2-HIST is accessed with the alternate name "10".

SAMPLE SOLUTION*ACCESS

```

FUNCTION? CREATE FILE
          CATALOG STRUCTURE TO WORKING LEVEL?
          /
          FILE NAME, SIZE(IN BLCKS), MAX SIZE? Q1-HIST, 1, 48*
SUCCESSFUL!
          FILE NAME, SIZE(IN BLCKS), MAX SIZE? Q2-HIST, 1, 48*
SUCCESSFUL!
          FILE NAME, SIZE(IN BLCKS), MAX SIZE? DONE
*GET Q1-HIST"10"
*GET LIBRARY/MGSIM,R
*RUN MGSIM
REV 0
LIST FILE MGSIM-IN FOR MORE INFORMATION

QUARTER NUMBER
=1

NUMBER OF FIRMS
=2

INDUSTRY NUMBER
=1

```

COMPANY NUMBER 1

PRICE OF PRODUCT

=6.30

PRODUCTION VOLUME (UNITS)

=440000

ADVERTISING EXPENSE

=250000

R&D EXPENSE

=150000

INVESTMENT IN PLANT AND EQUIPMENT

=250000

TOTAL DIVIDEND DECLARED

=100000

COMPANY NUMBER 2

PRICE OF PRODUCT

=6.75

PRODUCTION VOLUME (UNITS)

=440000

ADVERTISING EXPENSE

=400000

R&D EXPENSE

=200000

INVESTMENT IN PLANT AND EQUIPMENT

=200000

TOTAL DIVIDEND DECLARED

=0

FIRM 1 QUARTER 1 INDUSTRY 1

SALES VOLUME	513763
PERCENT OF INDUSTRY SALES	50.06
CURRENT INVENTORY QUANTITY	41583
PRODUCTION CPY NEXT QUARTER	441500

PROFIT AND LOSS

INCOME SALES REVENUE

3236706.72

EXPENSE

MANUFACTURING COSTS	1156050.95	
REDUCTION IN INVENTORY VALUE	221238.91	
RESEARCH AND DEVELOPMENT	150000.00	
DEPRECIATION	220000.00	
ADVERTISING AND SELLING	250000.00	
MISCELLANEOUS	161158.25	
ADMINISTRATION	340800.00	2499298.12
PROFIT BEFORE INCOME TAX		737408.59
ADDITION TO INCOME TAX FUND	353956.12	
NET PROFIT AFTER INCOME TAX		383452.47
DIVIDENDS PAID	100000.00	
ADDITION TO OWNERS EQUITY		283452.47

RECEIPTS AND DISBURSEMENTS

RECEIPTS SALES REVENUE		3236706.72
DISBURSEMENTS		
CASH EXPENSE	2058009.21	
ADDITION TO INCOME TAX FUND	353956.12	
DIVIDENDS PAID	100000.00	
INVESTMENT IN PLANT	250000.00	2761965.34
ADDITION TO CASH ASSETS		474741.38

FINANCIAL CONDITION

ASSETS

NET CASH ASSETS	3116311.38	
INVENTORY VALUE	124749.08	
PLANT NET BOOK VALUE	8830000.01	
OWNERS EQUITY		12071060.48

FIRM 2 QUARTER 1 INDUSTRY 1

SALES VOLUME	512404
PERCENT OF INDUSTRY SALES	49.93
CURRENT INVENTORY QUANTITY	42942
PRODUCTION CPY NEXT QUARTER	439000

PROFIT AND LOSS

INCOME SALES REVENUE	3458724.83
----------------------	------------

EXPENSE		
MANUFACTURING COSTS	1155520.50	
REDUCTION IN INVENTORY VALUE	217211.03	
RESEARCH AND DEVELOPMENT	200000.00	
DEPRECIATION	220000.00	
ADVERTISING AND SELLING	400000.00	
MISCELLANEOUS	160735.58	
ADMINISTRATION	340800.00	2694267.12
PROFIT BEFORE INCOME TAX		764457.71
ADDITION TO INCOME TAX FUND	366939.70	
NET PROFIT AFTER INCOME TAX		397518.01
DIVIDENDS PAID	0.00	
ADDITION TO OWNERS EQUITY		397518.01

RECEIPTS AND DISBURSEMENTS

RECEIPTS SALES REVENUE		3458724.83
DISBURSEMENTS		
CASH EXPENSE	2257056.08	
ADDITION TO INCOME TAX FUND	366939.70	
DIVIDENDS PAID	0.00	
INVESTMENT IN PLANT	200000.00	2823995.79
ADDITION TO CASH ASSETS		634729.04

FINANCIAL CONDITION

ASSETS		
NET CASH ASSETS	3276299.04	
INVENTORY VALUE	128826.96	
PLANT NET BOOK VALUE	8780000.01	
OWNERS EQUITY		12185126.02

2 FIRMS HAVE BEEN PROCESSED IN PERIOD 1 INDUSTRY 1

DO YOU WANT TO CONTINUE

=NO

MGSIM-10

~~*GET Q2-HIST"10";Q1-HIST"20"~~

~~*GET LIBRARY/MGSIM,R~~

~~*RUN MGSIM~~

REV 0

LIST FILE MGSIM-IN FOR MORE INFORMATION

QUARTER NUMBER

=2

NUMBER OF FIRMS

=2

INDUSTRY NUMBER

=1

COMPANY NUMBER 1

PRICE OF PRODUCT

=6.00

PRODUCTION VOLUME (UNITS)

=500000

ADVERTISING EXPENSE

=250000

R&D EXPENSE

=150000

INVESTMENT IN PLANT AND EQUIPMENT

=350000

TOTAL DIVIDEND DECLARED

=100000

COMPANY NUMBER 2

PRICE OF PRODUCT

=7.00

PRODUCTION VOLUME (UNITS)

=440000

ADVERTISING EXPENSE

=400000

R&D EXPENSE

=300000

INVESTMENT IN PLANT AND EQUIPMENT

=300000

TOTAL DIVIDEND DECLARED

=0

	FIRM 1	QUARTER 2	INDUSTRY 1
SALES VOLUME	541583		
PERCENT OF INDUSTRY SALES	52.93		
CURRENT INVENTORY QUANTITY	0		
PRODUCTION CPY NEXT QUARTER	447963		
 PROFIT AND LOSS			
INCOME SALES REVENUE			3249498.19
EXPENSE			
MANUFACTURING COSTS	1486768.64		
REDUCTION IN INVENTORY VALUE	124749.08		
RESEARCH AND DEVELOPMENT	150000.00		
DEPRECIATION	220750.00		
ADVERTISING AND SELLING	250000.00		
MISCELLANEOUS	153757.49		
ADMINISTRATION	341280.00		2727305.23
PROFIT BEFORE INCOME TAX			522192.95
ADDITION TO INCOME TAX FUND	250652.62		
NET PROFIT AFTER INCOME TAX			271540.33
DIVIDENDS PAID	100000.00		
ADDITION TO OWNERS EQUITY			171540.33
 RECEIPTS AND DISBURSEMENTS			
RECEIPTS SALES REVENUE			3249498.19
DISBURSEMENTS			
CASH EXPENSE	2381806.14		
ADDITION TO INCOME TAX FUND	250652.62		
DIVIDENDS PAID	100000.00		
INVESTMENT IN PLANT	350000.00		3082458.76
ADDITION TO CASH ASSETS			167039.42
 FINANCIAL CONDITION			
ASSETS			
NET CASH ASSETS	3283350.80		
INVENTORY VALUE	0.00		
PLANT NET BOOK VALUE	8959250.02		
OWNERS EQUITY			12242600.83

	FIRM 2	QUARTER 2	INDUSTRY 1
SALES VOLUME	481525		
PERCENT OF INDUSTRY SALES	47.06		
CURRENT INVENTORY QUANTITY	1417		
PRODUCTION CPY NEXT QUARTER	443025		

PROFIT AND LOSS

INCOME SALES REVENUE		3370675.30
EXPENSE		
MANUFACTURING COSTS	1170898.60	
REDUCTION IN INVENTORY VALUE	124575.12	
RESEARCH AND DEVELOPMENT	300000.00	
DEPRECIATION	219500.00	
ADVERTISING AND SELLING	400000.00	
MISCELLANEOUS	152074.32	
ADMINISTRATION	340480.00	2707528.05
PROFIT BEFORE INCOME TAX		663147.25
ADDITION TO INCOME TAX FUND	318310.68	
NET PROFIT AFTER INCOME TAX		344836.57
DIVIDENDS PAID	0.00	
ADDITION TO OWNERS EQUITY		344836.57

RECEIPTS AND DISBURSEMENTS

RECEIPTS SALES REVENUE		3370675.30
DISBURSEMENTS		
CASH EXPENSE	2363452.92	
ADDITION TO INCOME TAX FUND	318310.68	
DIVIDENDS PAID	0.00	
INVESTMENT IN PLANT	300000.00	2981763.60
ADDITION TO CASH ASSETS		388911.69

FINANCIAL CONDITION

ASSETS		
NET CASH ASSETS	3665210.73	
INVENTORY VALUE	4251.84	
PLANT NET BOOK VALUE	8860500.02	
OWNERS EQUITY		12529962.60

2 FIRMS HAVE BEEN PROCESSED IN PERIOD 2 INDUSTRY 1

DO YOU WANT TO CONTINUE

=NO

This BASIC program provides quick comparisons of different mortgage terms. The program computes and prints monthly payments, total interest, and differences for all possible combinations of input data.

INSTRUCTIONS

Type RUN to enter the following data:

1. Amounts to be borrowed (dollars only).
2. Interest rates (i.e., 6.5, 6, 10, 10.0).
3. Mortgage lives (years).

As each set of input is completed, the program asks a YES or NO reply to consider another set of terms. A YES allows another set of data to be input. A NO concludes the program.

SAMPLE PROBLEM

Compare mortgage terms for \$19,500 and \$30,000 at 6 and 7.5% over 20 and 30 years.

SAMPLE SOLUTION

*RUN

AMOUNTS TO BE CONSIDERED ?19500,30000
RATES TO BE CONSIDERED ?6,7.5
YEARS TO BE CONSIDERED ?20,30

MORTCST-2

FOR A LOAN OF 19500.00

INTEREST RATE	NUMBER OF YEARS	MONTHLY PAYMENT	TOTAL INTEREST	DECREASE MONTHLY PAYMENT	INCREASE TOTAL INTEREST
6.000%	20.00	139.70	14028.99		
6.000%	30.00	116.91	22588.46	22.79	8559.47
7.500%	20.00	157.09	18201.77		
7.500%	30.00	136.35	29584.87	20.74	11383.09

FOR A LOAN OF 30000.00

INTEREST RATE	NUMBER OF YEARS	MONTHLY PAYMENT	TOTAL INTEREST	DECREASE MONTHLY PAYMENT	INCREASE TOTAL INTEREST
6.000%	20.00	214.93	21583.05		
6.000%	30.00	179.87	34751.47	35.06	13168.42
7.500%	20.00	241.68	28002.73		
7.500%	30.00	209.76	45515.18	31.91	17512.45

DO YOU WISH TO CONSIDER ANOTHER SET OF TERMS ?NO

This FORTRAN program calculates a mortgage repayment schedule.

INSTRUCTIONS

To use this program, type RUN, and enter the following data as requested:

1. Amount of the loan (e.g., 37600 or 37600.50, etc.).
2. Interest rate per annum (e.g., 7 or 7.00 or 7.5, etc.).
3. Number of years of the mortgage (e.g., 30 or 20 or 10, etc.).

At this point, the minimum monthly payment is printed out. Then enter data as requested:

4. Actual monthly payments (i.e., amount of minimum monthly payment may be entered — 225.44 or some other desired payment — 275.00).
5. Payment start date (MO, YR.) (i.e., for September 1972 enter 9, 1972).
6. Number of months of payments to be listed, (i.e., for every month, type "1," for every year, type "12", for every two years, type "24", etc.).

If only the last payment line and summary is desired, enter some high figure such as 999.

7. Maximum number of lines: enter a figure of YRS. of mortgage by 12 divided by figure entered in item 6 above (e.g., 30 YRS by 12 ÷ 24 = 15). If only the summary line was requested in 6 above (e.g., 999, enter 999 here).

The program types out payment schedule for amounts paid on interest, on principal, total interest, the reducing balance, and a last payment date and amount.

SAMPLE PROBLEM

Calculate the 30-year repayment schedule for a \$37,600 mortgage at a 6% per year interest rate. The minimum and actual monthly payment is \$225.44. Payment is started in January 1965 and a line for every 24 payments is desired.

MORTGAGE-2

SAMPLE SOLUTION

READY
 *RUN
 LOAN AMOUNT
 = 37600.00
 INTEREST RATE (% PER YEAR)
 = 6
 YEARS
 = 30
 MIN MONTHLY PAYMENT 225.44
 ACTUAL MONTH PAYMENT
 = 225.44
 PAYMENTS START(MT,YR)
 = 1,1965
 PRINT LINE EVERY ? PAYMENTS
 = 24
 PRINT MAX OF ? LINES
 = 15

MORTGAGE REPAYMENT SCHEDULE (6.00%)
 MONTHLY PAYMENTS \$225.44

M-YR	INT PAY	PRIN PAY	TOT INT	BAL.	
0-65				37600.00	
12-66	183.45	41.99	4458.39	36647.82	
12-68	178.11	47.33	8795.69	35574.56	
12-70	172.09	53.35	12996.53	34364.83	
12-72	165.31	60.13	17043.53	33001.27	
12-74	157.66	67.78	20917.14	31464.32	
12-76	149.04	76.40	24595.31	29731.93	
12-78	139.33	86.11	28053.19	27779.26	
12-80	128.38	97.06	31262.77	25578.28	
12-82	116.03	109.41	34192.48	23097.42	
12-84	102.12	123.32	36806.71	20301.10	
12-86	86.44	139.00	39065.37	17149.20	
12-88	68.77	156.67	40923.23	13596.51	
12-90	48.84	176.60	42329.34	9592.05	
12-92	26.39	199.05	43226.23	5078.40	
12-94	1.08	215.15	43549.18	0.	LAST PAYMENT 216.22

*RUN
 LOAN AMOUNT
 = 37600
 INTEREST RATE (% PER YEAR)
 = 6.00
 YEARS
 = 30
 MIN MONTHLY PAYMENT 225.44
 ACTUAL MONTH PAYMENT
 = 225.44
 PAYMENTS START(MT,YR)
 = 1,1965
 PRINT LINE EVERY ? PAYMENTS
 = 999
 PRINT MAX OF ? LINES
 = 999

MORTGAGE REPAYMENT SCHEDULE (6.00%)
 MONTHLY PAYMENTS \$225.44

M-YR	INT PAY	PRIN PAY	TOT INT	BAL.		
0-65				37600.00		
12-94	1.08	215.15	43549.18	0.	LAST PAYMENT	216.22

This BASIC program computes effective annual rates of interest.

INSTRUCTIONS

Call out NOM-EFF and type RUN. Enter nominal interest rates (the limit is 20) in decimal form (i.e., 6, 6.5, 7.5, 8.75).

Then enter the number of times per year each rate is to be compounded. Enter (up to 20 whole numbers), i.e., 12, 365, 24, etc., or 0 for continuous compounding.

SAMPLE RUN

```
SYSTEM ?BASIC
OLD OR NEW-OLD NOM-EFF
READY
*RUN
```

```
NOMINAL ANNUAL INTEREST RATES--UP TO 20 DIFFERENT RATES
?12.61, 12.98, 6, 6.5, 12, 12.5
```

```
EACH RATE COMPOUNDED HOW MANY TIMES PER YEAR?
FOR EACH RATE YOU CAN TYPE IN UP TO 20 DIFFERENT COMPOUNDING
TIMES (TYPE IN A ZERO FOR CONTINUOUS COMPOUNDING)
```

```
FOR 12.61 ?21
FOR 12.98 ?30
FOR 6 ?0
FOR 6.5 ?2, 4, 6
FOR 12 ?12
FOR 12.5 ?0
```

NOMINAL ANNUAL %	TIMES COMP./ANNUM	EFFECTIVE ANNUAL %
-----	-----	-----
12.610	21	13.3968
12.980	30	13.8282
6.000	CONT. COMP.	6.1837
6.500	2	6.6056
6.500	4	6.6602
6.500	6	6.6786
12.000	12	12.6825
12.500	CONT. COMP.	13.3148

READY

This BASIC program computes annual rates of return compounded for an investment given the closing price for each year of data. Annual returns are computed every year, starting with the base year, and up to the last year in the data. Arithmetic average rates of return are computed for various holding periods starting with the same year. Also average rates of return, standard deviations, and coefficients of variation are computed for each possible holding period length within the years of data supplied.

METHOD

Data Entry Options

Data can be entered into RETURN in one of the two following options:

1. In DATA statements beginning at line 1000
2. Interactively

NOTE: Sample data is already imbedded in the program at line 1000-1100.

Data Content

Data entered into RETURN consists of:

1. The number of years for which annual data is provided (to a maximum of 25).
2. The annual return (dividend) and the annual closing price of the security for each of the years, starting with the base year and 0 annual return (i.e., 0, 1969).

INSTRUCTIONS

Type RUN, and the program asks DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA? The responses are:

DATA — Data is already entered in statements, use it and run.

YES — The program will print instructions, and the user will enter data interactively.

NO — The user enters data interactively with no program instructions printed.

SAMPLE PROBLEM

For this problem, the sample output is identical for all three input modes.

RETURN-2

Find the annual rate of return compounded for an investment made in 1962 and held to the present. The dividend per share and closing security price over that period are as follows:

1962:	0, \$39.25
1963:	\$1.02, \$43.65
1964:	\$1.10, \$46.75
1965:	\$1.20, \$60.125
1966:	\$1.30, \$60.00
1967:	\$1.30, \$58.00
1968:	\$1.30, \$50.25
1969:	\$1.30, \$49.125
1970:	\$1.30, \$47.25
1971:	\$1.40, \$66.50

Input Example 1

* RUN

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?DATA

Input Example 2

READY

* RUN

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?YES

FOR HOW MANY YEARS DO YOU WISH TO ENTER PRICE AND DIVIDEND DATA, REMEMBERING THE NEED FOR A BASE YEAR. E.G., 10 YEARS OF DATA ARE NEEDED TO GIVE 9 ANNUAL RETURNS. THE MAXIMUM NUMBER OF YEARS IS 25. ?10

WHAT IS THE FIRST YEAR FOR WHICH YOU WISH TO ENTER DATA ?1962

ENTER THE DIVIDEND PER SHARE (DPS) AND THE CLOSING SECURITY PRICE (CSP), SEPARATED BY A COMMA, FOR EACH OF THE FOLLOWING YEARS:

DPS, CSP

YEAR 1962	? <u>0,39.25</u>
YEAR 1963	? <u>1.02,43.65</u>
YEAR 1964	? <u>1.10,46.75</u>
YEAR 1965	? <u>1.20,60.125</u>
YEAR 1966	? <u>1.30,60.00</u>
YEAR 1967	? <u>1.30,58.00</u>
YEAR 1968	? <u>1.30,50.25</u>
YEAR 1969	? <u>1.30,49.125</u>
YEAR 1970	? <u>1.30,47.25</u>
YEAR 1971	? <u>1.40,66.50</u>

Input Example 3DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ? N0N0. OF YEARS, FIRST YEAR ? 10, 1962

DPS, CSP

YEAR 1962 ? ENTER AS ABOVE

SAMPLE SOLUTION

RETURNS ON INVESTMENTS

(ANNUAL RATES COMPOUNDED ANNUALLY)

T0 FROM	1963	1964	1965	1966
1962	.13808	.1172	.17721	.13695
1963		.09621	.19796	.13655
1964			.31176	.15799
1965				.01954

T0 FROM	1967	1968	1969	1970
1962	.10694	.06957	.06063	.05218
1963	.09883	.05535	.04709	.03916
1964	.09974	.04474	.03678	.02908
1965	.00398	-.0351	-.02594	-.02325
1966	-.01167	-.0622	-.04132	-.03427
1967		-.11121	-.05632	-.04204
1968			.00348	-.00405
1969				-.01171

T0 FROM	1971
1962	.08553
1963	.07842
1964	.07565
1965	.03794
1966	.04189
1967	.05648
1968	.1221
1969	.18897
1970	.43703

RETURN-4

AVERAGE RETURN FROM 1962 = .1049211
 AVERAGE RETURN FROM 1963 = .0936962
 AVERAGE RETURN FROM 1964 = .1079628
 AVERAGE RETURN FROM 1965 = -.003805
 AVERAGE RETURN FROM 1966 = -.021514
 AVERAGE RETURN FROM 1967 = -.0382725
 AVERAGE RETURN FROM 1968 = .04051
 AVERAGE RETURN FROM 1969 = .08863
 AVERAGE RETURN FROM 1970 = .43703

AVERAGE RETURN FOR ALL
 POSSIBLE HOLDING PERIODS = .0644873

		AVERAGE RETURN	STANDARD DEVIATION	COEFF. VARIATION
FOR ALL	1 YEAR HOLDING PERIODS:	.0968344	.1650436	1.70439
FOR ALL	2 YEAR HOLDING PERIODS:	.0679412	.1023104	1.505867
FOR ALL	3 YEAR HOLDING PERIODS:	.0595914	.0884425	1.484148
FOR ALL	4 YEAR HOLDING PERIODS:	.0461316	.0616345	1.336057
FOR ALL	5 YEAR HOLDING PERIODS:	.043542	.0416374	.9562584
FOR ALL	6 YEAR HOLDING PERIODS:	.04592	.0150662	.3280959
FOR ALL	7 YEAR HOLDING PERIODS:	.05848	.0149744	.2560594
FOR ALL	8 YEAR HOLDING PERIODS:	.0653	.01312	.2009188
FOR ALL	9 YEAR HOLDING PERIODS:	.08553	0	0
FOR ALL	POSSIBLE HOLDING PERIODS:	.0644873	.0991855	1.538062

This BASIC program is based on David B. Hertz's article, "Risk Analysis in Capital Investment."¹ Considering the factors that affect a set of cash flows, a business person is usually unable to project the value of each factor with certainty. However, he or she may be able to project a range of possible future values, attaching probabilities to several intervals within this range. For example, a business person may believe that there is a 60% chance of a new product selling at a price between \$X and \$Y, and only a 40% chance of it selling between \$Y and \$Z.

METHOD

RISKIT allows you to design your own model to project a set of cash flows. Instead of supplying one value for each factor in the model, you supply as data a number of possible values of each factor and your best guess as to the percentage change of the actual value lying between each pair of actual values. The program uses this information with a random number draw to calculate a value for a particular factor. The process continues until the model is complete, and one complete set of cash flows has been calculated. From the set of cash flows, a rate of return and a net present value is calculated.

This entire procedure is repeated for each different set of cash flows and, thus, a different rate of return and net present value is calculated. The end results are histograms, which indicate how many sets of flows have generated rates of return or net present values that fall into certain intervals. Calculating cash flows in this manner allows for entrance of the element of chance.

For most problems, you are required to have some knowledge of BASIC in order to write a routine that describes or models the interactions of the factors involved. Therefore, two requirements of RISKIT are the data on the factors involved, and the model of the interactions.

In order to simplify the instructions for this program, we have chosen, as an example, the case described in the original Harvard Business Review article. Familiarity with the article will help you understand the following information.

¹Hertz, D.B., "Risk Analysis in Capital Investment," Harvard Business Review, Volume 42, No. 1, January/February 1964.

RISKIT-2

INSTRUCTIONS

Entering Data

There are two ways to enter the data and model into the program. Entering data requires substitution of your own data for the library program, DATA, in lines 100-130. Entering a model requires that you substitute your model for lines 1000-1999 in the library program. In addition, a conversational routine is built into RISKIT to allow some of the input data to be provided by you while the program is running. Nevertheless, insertion of some data statements is required before a run.

Lines 100-199 are reserved for data; when entering your own data, overwrite or delete this program data in the library program. The following is a sample of the data entries that correspond to the case described in the Harvard Business Review article:

```
SYSTEM ?BASIC
ØLD ØR NEW-ØLD RISKIT
READY
*LIST 100-130
```

```
100 DATA 100
101 DATA 15
102 DATA 0
103 DATA 9
104 DATA LIFE,5
105 DADA 5,8,10,12,15
106 DATA 0,.10,.40,.40,.10
107 DATA MARKET SIZE,5
108 DATA 100000,170000,250000,295000,340000
109 DATA 0,.10,.30,.40,.20
110 DATA MARKET GRØWTH RATE,7
111 DATA 0,.01,.02,.03,.04,.05,.06
112 DATA 0,.05,.15,.30,.30,.15,.05
113 DATA SHARE ØF MARKET,6
114 DATA .03,.06,.09,.12,.15,.17
115 DATA 0,.10,.15,.40,.30,.05
116 DATA SELLING PRICE,5
117 DATA 385,450,510,540,575
118 DATA 0,.10,.45,.35,.10
119 DATA ØPERATING CØSTS,6
120 DATA 370,400,435,470,505,545
121 DATA 0,.15,.35,.35,.10,.05
122 DATA INVESTMENT,6
123 DATA 7000000,8000000,9000000,9500000,10000000,10500000
124 DATA 0,.05,.15,.35,.35,.10
125 DATA RESIDUAL VALUE,4
126 DATA 3500000,4000000,4500000,5000000
127 DATA 0,.20,.40,.40
128 DATA FIXED CØST,6
129 DATA 250000,275000,300000,325000,350000,375000
130 DATA 0,.10,.30,.30,.20,.10
```


The data is defined as follows:

- Line 100: Number of iterations or trials to be used to generate the cash flows.
- Line 101: Number of discrete increments wanted in histogram. With 100 iterations this probably should be somewhere between 12 and 20 — in this case 15.
- Line 102: Number of constants or nonrandom variables in model. This refers to any item in the model whose value remains the same for all sets of cash flows generated.

NOTE: If this data item is not zero, the user will have data on the constants in lines 103 and thereafter. For example, if the particular case contained two constants, months equal to 12 and purchase price equal to 250, lines 102-104 would be:

102 DATA, 2
103 DATA MONTHS, 12
104 DATA PURCHASE PRICE, 250

And the data now in lines 103 and thereafter would begin with line 105.

- Line 103: Number of random variable categories in model. These are the items whose ultimate values are selected randomly by the program.

NOTE: If this data item is zero, this program is not for you!

- Line 104: Name of the first variable factor, number of steps for this factor (no more than 8).
- Line 105: The upper limits for each step. Must be equal in number to the value stated in line 104 — in this case 5.
- Line 106: Estimates of the percentage chance of the future value falling into each step. The first number must always be 0, i.e., no chance of LIFE being less than 5. The rest of the data line reads: a 10% chance of LIFE between 5 and 8, a 40% chance of its being between 8 and 10, and 40% chance of its being between 10 and 12, and only a 10% chance of its being between 12 and 15. The chances should total 1.00, and there should be as many chances including the 0 — as there are data items in the line above.
- Line 107: See above, line 104. Lines 104-106 should be repeated for as many random variable factors as called for in line 103 — in this case 9.

The DATA statements must appear even if conversational mode is used. All of the numeric values can be dummy numbers. However, the DATA statements are read and the names of the constants and the random variable categories are used in the questioning process.

Programming the Model

The library program contains the model, described below:

*LIST 985-2000

```

985REM ** MODEL IS ENTERED IN LINES 1000-1999 **
990REM    NØ. ØF YEARS ØF LIFE
1000 LET N3 = INT(FNR(1) + .5)
1005REM    MARKET SIZE IN PERIOD 0
1010 LET A1=FNR(2)
1015REM    INVESTMENT CASH FLOW IN PERIOD 0
1020 LET F(0)=-1*FNR(7)
1030 LET G1=1
1035REM    FOR EACH YEAR ØF LIFE
1040 FOR I=1 TO N3
1045REM    MULTIPLICATIVE GROWTH RATE PERIOD I
1050 LET G1 = G1*(1+FNR(3))
1055REM    MARKET SIZE PERIOD I
1060 LET A2 = A1*G1
1065REM    QUANTITY PERIOD I
1070 LET A3 = A2*FNR(4)
1075REM    VALUE ØF SALES PERIOD I
1080 LET A4 = A3*FNR(5)
1085REM    ØPERATING CØSTS PERIOD I
1090 LET C1 = FNR(6)
1095REM    IS VALUE>=QTY * ØP.CØST
1100 IF A4>=A3*C1 THEN 1130
1110 LET A3 = 0
1120 LET A4 = 0
1125REM    TØTAL CØST PERIOD I
1130 LET A5 = FNR(9)+A3*C1
1135REM    CASH FLOW PERIOD I
1140 LET F(I) = A4-A5
1150 NEXT I
1155REM    ADD RESID. VALUE TO CASH FLOW LAST PERIOD
1160 LET F(N3) = F(N3)+FNR(8)
2000REM    ***** END ØF MØDEL *****

```

Values Within the Model

Dimensioned Variables — The dimensioned variables in the program are C(20), F(50), G(50), H(20), R(500), V(500), X(20,8), Y(20,8), Z(500), C\$(20), and X\$(20). These variables, with the exception of F(I), should not appear in your model.

Undimensioned Variables — Undimensioned variables that are not used in the program and that are available to the user are: A0, A1, A2, ... , A9; B0, B1, B2, ... , B9; and C0, C1, ... , C9.

$F(I)$ — The subscripted F represents the cash flow for a given or calculated period. You must write your program in such a way that you end up with a value for $F(0)$ — cash flow in period 0 — and values for $F(1)$ through $F(N3)$ — cash flow in period 1 through cash flow in last period (see lines 1020, and 1140).

$N3$ — Your model must calculate a value for $N3$, the number of periods of cash flow, excluding period 0, (see line 1000).

Function

$FNR(M)$ is a function which, using a random number generator, selects a value for a random variable factor given your value intervals and probabilities for that factor. Recall that in our example the DATA statements contain nine random variable factors. Looking at these DATA statements one can conclude that category #1 is LIFE, category #2 is MARKET SIZE, category #3 is MARKET GROWTH RATE, etc. In place of the M in $FNR(M)$ substitute the number, or index, of the factor whose value you want calculated. Thus the statement:

```
1010 LET A1 = FNR(2)
```

sets $A1$ equal to some MARKET SIZE, which falls within one of the intervals set by you.

The function is defined in lines 500-511, where $X(MK, 9)$ is the actual value for factor M , step $K9$; and $Y(M, K9)$ is the probability for category M , step $K9$, $K9 = 1$ to the number of steps in factor M .

Model's Location in RISKIT

When the model is confined to lines 985-1999, it is automatically embedded in the loop:

```
970 FOR IO = 1 TO N2
```

where $N2$ is the number of iterations specified in DATA line 100 — in our case it is 100. Thus, it is necessary to program the model as if it were to be run only once. RISKIT effects the iteration procedure. Use the variables I , J , K , and L with the FOR-NEXT statements in the model.

An explanation of what the model in our example is computing might be helpful in demonstrating how you would go about programming your own model. Remember that the model must provide values for $N3$, the number of periods, and $F(0)$ through $F(N3)$, the cash flows for every period including period 0.

The example used by Hertz in the Harvard Business Review article concerns introduction of a new product. A firm's management has provided the data on the nine key factors shown in DATA lines 104-130 and the relationships among these variables as described below.

- Line 1000: The number of periods is computed by rounding off, using the intergerizing function INT, the random draw for the LIFE of the project. LIFE is the first category or factor; therefore, FNR(1) provides the random draw for LIFE.
- Line 1010: The market size in period 0, A1, is set equal to the random draw for MARKET SIZE, the second category.
- Line 1020: The cash flow in period 0, F(0), is set equal to the negative of the random draw for INVESTMENT, the seventh category. If the values in DATA line 123 had been typed in as negatives, then line 1020 would read: 1020 LET F(0)=FNR(7).
- Line 1030: This line simply initializes the variable G1 to 1, since it represents the market growth rate in each period and is considered to be 1 in period 0.
- Line 1040: The cash flows, F(I), are computed for each period from 1 to N3 in a loop which extends from line 1040 to line 1150. I represents the index number of the period.
- Line 1050: The multiplicative market growth rate in period I, G1, is set equal to the growth rate in the previous period times one plus the MARKET GROWTH RATE in period I, the third category.
- Line 1060: The total market size in period I, A2, is set equal to the market size in period 0, A1, times the multiplicative market growth rate.
- Line 1070: The quantity to be sold by the firm in period I, A3, is set equal to the total market size, A2, times the random draw for SHARE OF MARKET, the fourth category.
- Line 1080: The total value of the sales of the firm in period I, A4, is set equal to the quantity sold, A3, times the random draw for SELLING PRICE, the fifth category.
- Line 1090: The operating cost per item in period I, C1, is set equal to the random draw for OPERATING COSTS, the sixth category.
- Lines 1100-1120: If the total value of the sales by the firm, A4, are greater than or equal to the total operating costs, A3 times C1, then the firm will produce the product in period I and both the quantity to be sold, A3, and the total value of sales, A4, will retain their values previously computed. If A4 is less than total operating costs, then both A3 and A4 are set equal to 0, that is, in period I the firm will not produce or sell any of the product thus avoiding all marginal costs.
- Line 1130: The total costs in period I, A5, is set equal to the random draw for FIXED COST, the ninth category, plus the total operating costs, A3 times C1.

- Line 1140: The cash flow in period I, $F(I)$, is set equal to the value of sales in period I, A4, minus the total period costs, A5.
- Line 1160: The cash flow in the last period, $F(N3)$, is set equal to the value previously computed in line 1140 for $F(N3)$ plus the random draw for RESIDUAL VALUE, the eighth category.

Changes in RISKIT

Sometimes it is necessary to eliminate the rate of return routine because it can be programmed in too simple a manner to allow for all the solutions possible in calculating rate of return. Thus if the model creates a set of flows that never change sign, the error message OVERFLOW is typed; the model should be reprogrammed or the rate of return eliminated. To eliminate the rate of return routine, type: 214 LET Z8+0.

Net present values are currently set to be discounted at 10%. If you desire another rate, change line 216 to: LET Z9+.10 (10% discounting — any other discount rate may be used here). For no discounting, change line 216 to 0: 216 LET Z9+0.

In the following example, the output begins with the set of cash flows generated during the first iteration. These flows allow you to perform a quick check to see if they appear reasonable. Flows for the remaining iterations are not printed because the output would be too long.

Following the first iteration's cash flows are histograms for the rates of return, net present values and ratios of net present values (i.e., the ratios of positive flows to negative flows). Following each histogram are the mean and standard deviation of the particular measure plotted in the histogram.

RISKIT-8

SAMPLE RUN

*
SYSTEM ?BASIC
OLD OR NEW-OLD RISKIT
READY
*RUN

DO YOU WANT TO USE DATA: (YES OR NO) ?YES

FLWS FOR THE FIRST ITERATION FOR 12 PERIODS

PERIOD	FLOW
0	-9216754
1	3227312
2	1029929
3	-282727.8
4	1326603
5	2133060
6	3264068
7	5674858
8	878938.6
9	981559.9
10	4040488
11	9438514

RATES OF RETURN FOR 100 SAMPLES

.011	LESS THAN .022	***	3
.022	LESS THAN .055	*****	6
.055	LESS THAN .088	*****	11
.088	LESS THAN .121	*****	12
.121	LESS THAN .154	*****	18
.154	LESS THAN .187	*****	19
.187	LESS THAN .22	*****	11
.22	LESS THAN .253	*****	7
.253	LESS THAN .286	*****	6
.286	LESS THAN .319	****	4
.319	LESS THAN .352	**	2
.352	LESS THAN .385		0
.385	LESS THAN .418		0
.418	LESS THAN .451	*	1
.451	LESS THAN .484		0

MEAN .1595

STANDARD DEVIATION .0809

NET PRESENT VALUES FOR 100 SAMPLES

FOR ACTUAL VALUE MULTIPLY BY 1000

-5391	LESS THAN	-3962	**	2
-3962	LESS THAN	-2533	*****	6
-2533	LESS THAN	-1104	*****	10
-1104	LESS THAN	325	*****	6
325	LESS THAN	1754	*****	16
1754	LESS THAN	3183	*****	12
3183	LESS THAN	4612	*****	11
4612	LESS THAN	6041	*****	16
6041	LESS THAN	7470	*****	8
7470	LESS THAN	8899	*****	5
8899	LESS THAN	10328	***	3
10328	LESS THAN	11756	*	1
11756	LESS THAN	13185	**	2
13185	LESS THAN	14614	*	1
14614	LESS THAN	16043	*	1

MEAN 3101307

STANDARD DEVIATION 4108050

RATIOS OF NET PRESENT VALUE FOR 100 SAMPLES

.4592	LESS THAN	.6222	**	2
.6222	LESS THAN	.7852	*****	9
.7852	LESS THAN	.9482	*****	9
.9482	LESS THAN	1.1112	*****	11
1.1112	LESS THAN	1.2742	*****	18
1.2742	LESS THAN	1.4372	*****	12
1.4372	LESS THAN	1.6002	*****	12
1.6002	LESS THAN	1.7632	*****	11
1.7632	LESS THAN	1.9262	*****	9
1.9262	LESS THAN	2.0892	**	2
2.0892	LESS THAN	2.2522	***	3
2.2522	LESS THAN	2.4152		0
2.4152	LESS THAN	2.5782	*	1
2.5782	LESS THAN	2.7412		0
2.7412	LESS THAN	2.9042	*	1

MEAN 1.3327

STANDARD DEVIATION .4334

RISKIT-10

SAMPLE RUN 2

Sample Run 2 shows a run of RISKIT using the conversational mode, which is activated by answering NO to the first question. The DATA statements used in the Sample Run are still in the program, but only the names of the nine categories will be used, and the remaining data could be replaced by 0. As the output in Sample Run 2 shows, conversational mode forces the range of values for each random variable category into five steps rather than allowing you to specify the number of steps, as is the case with DATA statements. Also, conversational mode permits you to make changes to any of the inputs both before and after the histograms are printed.

```
READY
*#
SYSTEM ?BASIC
OLD OR NNEW-OLD RISKIT
READY
*RUN
```

DO YOU WANT TO USE DATA; (YES OR NO) ?NO

HOW MANY CONSTANTS IN YOUR MODEL ?0

HOW MANY RANDOM VARIABLE CATEGORIES IN YOUR MODEL ?9

FOR THE FOLLOWING ITEMS THE USER SHOULD ENTER THE EXPECTED VALUE, THE LOWEST REASONABLE VALUE AND THE HIGHEST REASONABLE VALUE. SEPARATE BY COMMAS.

FOLLOWING THE USER'S ENTRIES A RANGE OF VALUES WILL BE TYPED OUT. UNDER THIS WILL BE THE PERCENTAGE CHANCE THAT THE VALUE WILL FALL WITHIN A GIVEN RANGE.

NOTEIF THE USER IS UNHAPPY WITH THESE FIGURES, HE WILL HAVE AN OPPORTUNITY TO CHANGE THEM LATER ON.

	EXPECTED, LOW, HIGH							
1 LIFE	<u>?10,510,15</u>							
5	.1	8	.5	10	.3	13	.1	15
2 MARKET SIZE	<u>?250000,100000,340000</u>							
100000	.1	175000	.225	250000	.575	295000	.1	340000

3 MARKET GROWTH RATE ?.035,0,.06

0	.0175	.035	.0475	.06
.1		.2833333	.5166667	.1

4 SHARE OF MARKET ?.12,.03,.17

.03	.075	.12	.145	.17
.1		.1999999	.6000001	.1

5 SELLING PRICE ?510,365,575

365	438	510	543	575
.1		.1380952	.6619048	.1

6 OPERATING COSTS ?450,370,545

370	410	450	498	545
.1		.4624999	.3375001	.1

7 INVESTMENT ?9500000,7000000,10500000

7000000	8250000	9500000	1.000000E 07
1.050000E 07	.1	.0999999	.7000001

8 RESIDUAL VALUE ?4500000,3500000,5000000

3500000	4000000	4500000	4750000	5000000
.1		.1666666	.6333334	.1

9 FIXED COST ?325000,250000,375000

250000	287500	325000	350000	375000
.1		.2599999	.5400001	.1

RISKIT-12

DO YOU WANT TO CHANGE ANYTHING ?YES

INDEX NUMBER OF ITEM TO CHANGE ?5

DO YOU WANT NEW VALUES ?YES

INPUT 5 NEW VALUES ?385,448,510,543,575

DO YOU WANT NEW PERCENTAGES ?YES

INPUT 4 NEW PERCENTAGES ?.1,.5,.3,.1

385		448		510		543		575
	.1		.5		.3		.1	

DO YOU WANT TO CHANGE ANYTHING ?YES

INDEX NUMBER OF ITEM TO CHANGE ?9

DO YOU WANT NEW VALUES ?YES

INPUT 5 NEW VALUES ?250000,275000,300000,325000,375000

DO YOU WANT NEW PERCENTAGES ?NO

250000		275000		300000		325000		375000
	.1		.2599999		.5400001		.1	

DO YOU WANT TO CHANGE ANYTHING ?NO

HOW MANY TIMES DO YOU WANT TO ITERATE. (0 WILL STOP PROGRAM)
? 0

This BASIC program provides a summary presentation of inventory turnover and profit margin information for each department of a firm. The user enters the sales, purchases, and beginning and ending inventories for each department.

INSTRUCTIONS

To use, type RUN, and enter the following information as requested:

1. Number of departments
2. Number of months to be analyzed
3. Company name
4. For each department:
 - sales
 - beginning inventory
 - ending inventory
 - purchases

SAMPLE PROBLEM

Joe Doe Co., a relatively unprofitable company, has three departments with the following statistics over the past 12 months:

- Dept. 1: \$300,000 in sales, \$400,000 in initial inventory, \$300,000 in final inventory, and \$300,000 in purchases.
- Dept. 2: \$200,000 in sales, \$300,000 in initial inventory, \$200,000 in final inventory, and \$200,000 in purchases.
- Dept. 3: \$500,000 in sales, \$600,000 in initial inventory, \$500,000 in final inventory, and \$500,000 in purchases.

Summarize the departments' inventory turnover and profit margin.

SALDATA-2

SAMPLE RUN

*RUN

HOW MANY DEPARTMENTS DO YOU HAVE ? 3
 PERIOD LENGTH(MOS) ? 12
 COMPANY NAME ? JOE DOE CO.

FOR EACH DEPARTMENT ENTER:

SALES, BEGINNING INVENTORY, ENDING INVENTORY, PURCHASES

1 ? 300000, 400000, 300000, 300000
 2 ? 200000, 300000, 200000, 200000
 3 ? 500000, 600000, 500000, 500000

JOE DOE CO.

		SALES	C/G/S	%C/G/S	GROSS PROFIT	% GROSS PROFIT
DEPT	1	300000	400000	133.33	-100000	-33.33
DEPT	2	200000	300000	150	-100000	-50
DEPT	3	500000	600000	120	-100000	-20
TOTALS		1000000	1300000	130	-300000	-30

		PERCENT OF SALES	PERCENT OF C/G/S	PERCENT GROSS PFT	PERCENT INVENTORY	DAYS INVENTORY
DEPT	1	30	30.77	33.33	30	315 DAYS
DEPT	2	20	23.08	33.33	20	300 DAYS
DEPT	3	50	46.15	33.33	50	330 DAYS

OVERALL INVENTORY TURNOVER 276.92 DAYS

The BASIC program calculates the amount of money that would accumulate after N years at an annual interest rate R compounded T times per year, when the initial amount is P and an amount D is added at the beginning of each subsequent year.

INSTRUCTIONS

To use this program, type RUN and enter the data as requested.

RESTRICTIONS

P and D must be given in dollars, N and T in integers, and R as a percentage. For additional instructions, list the program.

SAMPLE PROBLEM

Calculate the amount of money that would accumulate after four years at an interest rate of 6% if the original amount was \$6000, if \$200 is added at the beginning of the second, third, and fourth year. Interest is compounded four times per year.

SAVING-2

SAMPLE SOLUTION

*RUN

SAVING

THIS PROGRAM CALCULATES THE AMOUNT OF MONEY THAT WOULD ACCUMULATE AFTER N YEARS AT AN ANNUAL INTEREST RATE R COMPOUNDED T TIMES PER YEAR, WHEN THE INITIAL AMOUNT IS P AND AN AMOUNT D IS ADDED AT THE BEGINNING OF EACH SUBSEQUENT YEAR. NOTE THAT P AND D ARE GIVEN IN DOLLARS, N AND T MUST BE INTEGERS, AND R IS GIVEN AS A PERCENTAGE.

WHAT ARE P,D,N,T,R ? 6000,200,4,4,6

AFTER 4 YEARS, 6000 DOLLARS INVESTED AT 6
PERCENT COMPOUNDED 4 TIMES PER YEAR, WITH THE
ADDITION OF 200 DOLLARS PER YEAR, YIELDS A TOTAL
OF 8290.608 DOLLARS.

MORE DATA (1=YES, 0=NO) ? 1

WHAT ARE P,D,N,T,R ? 6000,0,4,4,6

AFTER 4 YEARS, 6000 DOLLARS INVESTED AT 6
PERCENT COMPOUNDED 4 TIMES PER YEAR, WITH THE
ADDITION OF 0 DOLLARS PER YEAR, YIELDS A TOTAL
OF 7613.913 DOLLARS.

MORE DATA (1=YES, 0=NO) ? 1

WHAT ARE P,D,N,T,R ? 0,200,4,4,6

AFTER 4 YEARS, 0 DOLLARS INVESTED AT 6
PERCENT COMPOUNDED 4 TIMES PER YEAR, WITH THE
ADDITION OF 200 DOLLARS PER YEAR, YIELDS A TOTAL
OF 676.6948 DOLLARS.

MORE DATA (1=YES, 0=NO) ? 1

WHAT ARE P,D,N,T,R ? 6000,200,4,1,5.25

AFTER 4 YEARS, 6000 DOLLARS INVESTED AT 5.25
PERCENT COMPOUNDED 1 TIMES PER YEAR, WITH THE
ADDITION OF 200 DOLLARS PER YEAR, YIELDS A TOTAL
OF 8027.977 DOLLARS.

MORE DATA (1=YES, 0=NO) ? 0

This BASIC program simulates the future performance of an investment fund.¹ SIMFUND is linked to a plotting program, SIMPLOT, which draws histograms. Before running SIMFUND, you must save an empty file called ENDFUND.

METHOD

In running SIMFUND, specify the annual rate of return you expect the fund to earn (this is total return, made up of income and appreciation), that is, the most likely rate of return in any future year, and the standard deviation you expect the future rates of return to show. In addition, SIMFUND permits you to specify a rate at which new money will be added to the fund, and a rate at which money will be withdrawn from it. The program applies these two rates to the average of the three preceding year-end values of the fund.

The program assumes the fund begins with \$100 and compounds this \$100 forward for 50 years. For each year it selects a rate of return from a log normal distribution (specified by the expected rate of return and standard deviation you have called for) and uses this rate to compound the fund. For each year it adds new money and subtracts withdrawals, using the rates you provided and applying them to the average of the three preceding year-end values of the fund. Selection of a rate from a log normal distribution involves a random element, so that rarely will the program draw two identical rates of return over the 50 years. The rates can be expected, however, to form a pattern that closely approximates a log normal distribution. The choice of this particular distribution is discussed in the text referenced previously. It is perhaps not the ideal distribution for forecasting fund returns, but it is simple and seems to work fairly well. The formulas used can be seen by listing them from the program:

*LIST 190-250, 1020-1080

A single series of 50 rates of return, calculated as described above, does not tell much about what may happen over those years — it represents only a single draw from a random distribution for each year. So the program repeats the 50-year compounding 100 times and displays the results of these 100 simulations.

¹For a discussion of simulation as a device for testing and comparing investment strategies, see Williamson, Peter, J., New Analytical Techniques, Amos Tuck School, Dartmouth University, Hanover, New Hampshire, Chapters 3 and 9.

SAMPLE PROBLEM 1

For Sample Problem 1, we have specified an expected return of 15% with a standard deviation of 13%. We have specified no additions or withdrawals, and asked for a display of terminal fund values (TV's) every five years. The program responds by running 100 simulations over 50 years, and printing a summary of results, a year at a time for the first five years, and then at five year intervals. (The interval called for must divide evenly into 50.) At the end of year 20, the lowest and highest values were \$245.37 and \$5868.67, and the average was \$1716.58.

The table helps illustrate the results that are possible and probable if future returns are characterized by a means of 15% with a standard deviation of 13%. However, a histogram gives a better picture. As the run of the program proceeds, provide a name for your fund, for future identification of histograms, and the year at which you want a histogram printed (which must be one of the years in the table above). In the example, a histogram at twenty years has been called for, with no respacing (discussed below).

Histograms can be called, for any time period listed in the initial table, and the expected results of an investment strategy can be compared over future years and with the expected results of a different strategy.

SAMPLE PROBLEM 2

Sample Problem 2 shows a run in which the user specified an expected return of 8%, a standard deviation of 7%, and also called for new money to be added at 1% a year and withdrawals to be made at 4.5%. As in Sample Problem 1, a table is printed, this time showing under AVERAGE SPENDING, the average withdrawal calculated in the 100 simulations. (For the first year, each simulation calculates spending of exactly \$4.50 because of the averaging.)

The first histogram called for is at one year, and shows about a one-third chance that the \$100 investment will have depreciated over the first year, with \$85 the lowest result of any simulation. A second histogram shows the distribution of fund values at ten years, and the distribution of withdrawals at ten years. This second distribution is the result of applying the 4.5% spending rule to average fund values over three years — averages that vary from simulation to simulation. The example suggests little likelihood of a withdrawal for spending in the tenth year below about \$4 or above approximately \$8 per \$100 initial investment.

As Sample Problem 2 continues, the user has asked again for histograms at ten years, but has requested respacing, indicating intervals of 0-250 for fund values, and 0-10 for withdrawals. If no respacing is called for, the program automatically divides the range from the smallest value to the largest by 10, and the histogram follows these ten intervals. Respacing allows you to choose your own range and interval size to be used in the histograms. In this example, the histogram for fund values has been set to cover the range 0 to \$250 in steps of \$25. The single asterisk between 250 and 280 indicates that one value fell above the 0 to 250 range. The histogram for withdrawals has been set to cover the range 0 to \$10 in steps of \$1, and no values fell outside this range.

The histograms are actually drawn by the program SIMPLOT, to which SIMFUND chains. SIMPLOT operates from the file ENDFUND, created by SIMFUND. The simulations run by SIMFUND are very time-consuming, and if you are interrupted in calling for histograms it is not necessary to run the simulation again. Just call out SIMPLOT and run it.

SAMPLE RUN 1

BASIC
 OLD OR NEW-OLD SIMFUND
 READY
 *RUN

WHAT ARE EXPECTED RATE OF RETURN AND STANDARD DEVIATION ? .15 .13
 AT WHAT RATE DO YOU EXPECT NEW MONEY TO BE ADDED ? 0
 WHAT RATE OF SPENDING IS BUDGETED ? 0
 AT WHAT INTERVALS DO YOU WISH TV'S ? 5

TOTAL RETURN FUND AT END OF:

PERIOD	UPPER BOUND	MEAN	LOWER BOUND	AVERAGE SPENDING
1	141.15	115.35	80.41	.00
2	210.33	134.16	84.03	.00
3	235.50	152.57	87.51	.00
4	290.92	176.12	97.47	.00
5	406.55	202.09	100.82	.00
10	1024.97	421.27	115.70	.00
15	2298.53	842.70	223.54	.00
20	5868.67	1716.58	245.37	.00
25	16643.58	3798.55	499.89	.00
30	33823.20	7677.73	736.18	.00
35	87232.97	15754.43	1117.45	.00
40	157535.17	30699.46	2294.71	.00
45	333111.65	61627.30	6005.92	.00
50	640792.34	126456.81	8064.77	.00

SIMFUND-4

WHICH FUND ?ABC
AT WHICH PERIOD DO YOU WANT A HISTOGRAM ?20
DO YOU WISH TO RESPACE ?N0

FUND ABC DISTRIBUTION OF FUND VALUES AT 20 YEARS

245	:
	:*****
807	:
	:*****
1369	:
	:*****
1931	:
	:*****
2494	:
	:*****
3056	:
	:***
3618	:
	:**
4181	:
	:**
4743	:
	:*
5305	:
	:*
5868	:

AT WHICH PERIOD DO YOU WANT A HISTOGRAM ?0

SYSTEM ?BASIC
 OLD OR NEW-OLD SIMFUND
 READY
 *RUN

WHAT ARE EXPECTED RATE OF RETURN AND STANDARD DEVIATION ?.08, .07
 AT WHAT RATE DO YOU EXPECT NEW MONEY TO BE ADDED ?.01
 WHAT RATE OF SPENDING IS BUDGETED ?.045
 AT WHAT INTERVALS DO YOU WISH TV'S ?10

TOTAL RETURN FUND AT END OF:

PERIOD	UPPER BOUND	MEAN	LOWER BOUND	AVERAGE SPENDING
1	118.18	104.69	84.57	4.50
2	144.53	110.23	83.37	4.57
3	149.62	114.60	82.01	4.72
4	163.51	120.25	84.33	4.94
10	280.73	160.99	74.11	6.51
20	556.70	254.66	79.37	10.51
30	1103.35	424.64	106.62	17.33
40	1936.71	668.20	145.28	27.75
50	3111.87	1063.14	212.58	43.30

WHICH FUND ?BCD
 AT WHICH PERIOD DO YOU WANT A HISTOGRAM ?1
 DO YOU WISH TO RESPACE ?NO

FUND BCD DISTRIBUTION OF FUND VALUES AT 1 YEARS

```

84      :
        : *
87      :
        : ***
90      :
        : **
94      :
        : *****
97      :
        : *****
100     :
        : *****
104     :
        : *****
107     :
        : *****
110     :
        : *****
114     :
        : *****
117     :
  
```

SIMFUND-6

AT WHICH PERIOD DO YOU WANT A HISTOGRAM ?10
DO YOU WISH TO RESPACE ?N0

FUND BCD DISTRIBUTION OF FUND VALUES AT 10 YEARS

74	:
	:***
94	:
	:*****
115	:
	:*****
135	:
	:*****
156	:
	:*****
177	:
	:*****
197	:
	:*****
218	:
	:***
239	:
	:**
259	:
	:*
280	:

FUND BCD DISTRIBUTION OF WITHDRAWALS AT 10 YEARS

3.38	:
	:**
4.07	:
	:*****
4.76	:
	:*****
5.46	:
	:*****
6.15	:
	:*****
6.85	:
	:*****
7.54	:
	:*****
8.24	:
	:*****
8.93	:
	:**
9.63	:
	:*
10.32	:

AT WHICH PERIOD DO YOU WANT A HISTOGRAM ?10
 DO YOU WISH TO RESPACE ?YES
 WHAT ENDPOINTS ?0,250,0,10

FUND BCD DISTRIBUTION OF FUND VALUES AT 10 YEARS

```

0      :
      :*
25     :
      :*
50     :
      :*
75     :
      :**
100    :
      :*****
125    :
      :*****
150    :
      :*****
175    :
      :*****
200    :
      :*****
225    :
      :*****
250    :
      :*
280    :
  
```

FUND BCD DISTRIBUTION OF WITHDRAWALS AT 10 YEARS

```

0      :
      :*
1      :
      :*
2      :
      :*
3      :
      :**
4      :
      :*****
5      :
      :*****
6      :
      :*****
7      :
      :*****
8      :
      :*****
9      :
      :**
10     :
      :*
10     :
  
```

AT WHICH PERIOD DO YOU WANT A HISTOGRAM ?0

This BASIC program computes and prints a monthly payments schedule for a Small Business Administration (SBA) loan. At the end of each calendar year and at the final retirement of the loan, it also prints a comprehensive summary statement giving the beginning principal, ending principal, principal repayments made, and total interest paid during the year. The program first computes the monthly interest charges on the two respective shares of the loan. The residual of the monthly payment after deduction of these interest charges is then used to repay the loan principals of the two shares. The program assumes that the service fee charged by the bank will be reimbursed by the SBA.

INSTRUCTIONS

Type RUN and enter the following data as requested.

1. Borrower's name: enter the name without using commas such as before JR.
2. Original principal: enter the amount without a dollar sign or without commas.
3. SBA share: enter the SBA share expressed as a percent, (e.g., 40% is entered as 40).
4. Bank rate: enter the interest rate charged by the bank expressed as a percent.
5. SBA rate: enter the interest rate charged by the SBA expressed as a percent.
6. Loan date: enter the month and year of the loan. The month should be expressed as the number of the month (i.e., January = 1, February = 2, etc.) and the year as a four digit number. The month and the year should be separated by a comma.
7. Monthly payment: enter the monthly payment without a dollar sign and without commas.
8. Service fee: enter the annual service charge expressed as a decimal part of 1%. For example, 1/4 of 1% is entered as .25.
9. Number of calendar years for schedule: enter the number of years for which you wish the schedule printed.

SAMPLE PROBLEM

Print a one-year monthly payment schedule for an SBA loan of \$30,000 to J.R. Craig, dated September 1972. The bank rate is 8.5%, the SBA rate is 6%. The SBA assumes 40% of the loan and a service fee is 1/4 of 1%. Do not list the program for instructions.

SMLBUS-2

SAMPLE SOLUTION

* RUN

PLEASE LIST THIS PROGRAM FOR INSTRUCTIONS.

BORROWER'S NAME ?J.R.CRAIG
ORIGINAL PRINCIPAL ?30000
SBA SHARE ?40
BANK RATE ?8.5
SBA RATE ?6
LOAN DATED (MO,YR) ?9, 1972
MONTHLY PAYMENT ?500
SERVICE FEE(%) ?25
FOR HOW MANY CALENDAR YEARS DO YOU WISH THE SCHEDULE ?1

****SBA LOAN SCHEDULE****

BORROWER: J.R.CRAIG
AMOUNT OF LOAN 30000.00
SBA PARTICIPATION: 40 %
SBA INTEREST RATE: 6 %
BANK INTEREST RATE: 8.5 %
MONTHLY PAYMENT: 500.00

	BEGINNING PRINCIPAL	INTEREST PAYMENT	PRINCIPAL REPAYMENT	SERVICE FEE	TOTAL PAYMENT
=====					
PMT # 1 OCT, 1972					
TOTAL LOAN	30000.00	187.50	312.50		500.00
SBA SHARE	12000.00	60.00	125.00	-2.50	182.50
BANK SHARE	18000.00	127.50	187.50	2.50	317.50

=====					
PMT # 2 NOV, 1972					
TOTAL LOAN	29687.50	185.54	314.46		500.00
SBA SHARE	11875.00	59.37	125.78	-2.47	182.68
BANK SHARE	17812.50	126.17	188.68	2.47	317.32

=====					
PMT # 3 DEC, 1972					
TOTAL LOAN	29373.04	183.59	316.41		500.00
SBA SHARE	11749.22	58.75	126.57	-2.45	182.87
BANK SHARE	17623.82	124.84	189.84	2.45	317.13

=====

FOR 1972 :

BEGINNING PRINCIPAL	30000.00
ENDING PRINCIPAL	29056.63
PRINCIPAL REPAYMENT	943.37
TOTAL INTEREST PAID	556.63

=====

This BASIC program calculates the true annual interest rate charged on an installment loan.

INSTRUCTIONS

To use this program, type RUN and supply values for the four variables:

- A, amount of loan in dollars
- P, amount of each payment in dollars
- N, the total number of payments due
- K, the number of payments due in one year

For additional instructions, list the program.

SAMPLE PROBLEM

Determine the true interest charged on these two loans:

Loan 1 is for \$600 for 21 months with a payback of \$31.99 per month. Loan 2 is for \$1400 for 30 months with a payback of \$54.90 per month. The bank's stated rate is 6%. The input data would be:

Loan 1

A = Amount of Loan = \$600.00
P = Amount of each payment = \$31.99
N = Total Number of Payments = 21
K = Number of Payments in one year = 12

Loan 2

A = \$1400.00
P = \$54.90
N = 30
K = 12

SAMPLE SOLUTION

*RUN

TRUINT

THIS PROGRAM WILL CALCULATE THE TRUE ANNUAL INTEREST RATE CHARGED ON AN INSTALLMENT LOAN. YOU SUPPLY THE VALUES OF FOUR VARIABLES: A = AMOUNT OF LOAN (IN \$), P = AMOUNT OF EACH PAYMENT (\$), N = THE TOTAL NUMBER OF PAYMENTS DUE, AND K = THE NUMBER OF PAYMENTS DUE IN ONE YEAR. WHAT ARE A,P,N,K ?600.00,31.99,21,12

TRUE ANNUAL INTEREST RATE (NOMINAL)= 12.61
TRUE ANNUAL INTEREST RATE (EFFECTIVE)= 13.36

ANOTHER CASE? (TYPE 'S' TO STOP NOW).
WHAT ARE A,P,N,K ?1400.00,54.90,30,12

TRUE ANNUAL INTEREST RATE (NOMINAL)= 12.98
TRUE ANNUAL INTEREST RATE (EFFECTIVE)= 13.78

ANOTHER CASE? (TYPE 'S' TO STOP NOW).
WHAT ARE A,P,N,K ?S

The BASIC program calculates the intrinsic value of stock.

The intrinsic value of a stock, according to the theory described by John Burr Williams in The Theory of Investment Value,¹ and by Nicholas Molodovsky in a number of articles in the Financial Analysts Journal, is the discounted present value of the stream of dividends the shareholder expects to receive:

$$V = \frac{d_1}{1+r} + \frac{d_2}{(1+r)^2} + \frac{d_3}{(1+r)^3} + \dots$$

where

- V is the intrinsic value
- d_1 is the dividend expected next year
- d_2 is the dividend expected the year after, and so on indefinitely
- r is the discount rate (rate of return the investor expects to earn on purchase of the stock)

The expected dividends d_1 , d_2 , and so on, can be replaced by the expected earnings e_1 , e_2 , and so on, multiplied by the payout rate p. The earnings estimates can be further replaced by the present normalized earnings, e_0 , and the expected growth rate g.

$$V = e_0 p \left(\frac{1+g}{1+r} + \frac{(1+g)^2}{(1+r)^2} + \frac{(1+g)^3}{(1+r)^3} + \dots \right)$$

The normalized current earnings figure is simply the earnings per share that could be expected in this year apart from unusual conditions. One way to estimate normalized earnings is to extrapolate a trend line of earnings per share. The point is that since the forecasts of all future earnings are based on e_0 , it is important that e_0 not be influenced by temporary factors.

Molodovsky has suggested the use of two growth rates: one relatively short term (perhaps extending twenty or thirty years) and another long term. His reasoning is that even high growth companies reach a level of maturity when growth stabilizes at the long term growth rate of the industry. He suggests that approximately 4% a year is an appropriate long term growth rate for most companies.

¹For a more complete review of the intrinsic value approach, see Williamson, J. Peter, Investments: New Analytic Techniques, Hanover, New Hampshire, Amos Tuck School, Dartmouth University, Chapter VI.

Both Williams and Molodovsky prefer to calculate intrinsic value from dividend projections alone, implicitly assuming that if a shareholder anticipates selling stock in the future, the best estimate of what will be received for it then is the forecasted intrinsic value at that time. Since this forecasted intrinsic value will be just the value at that time of the stream of dividends to come, and since this is precisely the value that the calculations described above make use of to account for the value at that future time in deducing the present intrinsic value, there is no need to consider separately the results of a future sale.

Some analysts, however, are more comfortable predicting the price/earnings ratio of a stock at some future time than they are predicting earnings growth rates indefinitely into the future. For them, the appropriate formula is:

$$V = e_0 p \left(\frac{(1 + g_1)}{1 + r} + \frac{(1 + g_1)(1 + g_2)}{(1 + r)^2} + \frac{(1 + g_1)(1 + g_2)(1 + g_3)}{(1 + r)^3} + \dots \right. \\ \left. + \frac{(1 + g_1)(1 + g_2) \dots (1 + g_n)}{(1 + r)^n} \right) \\ c_0 + \frac{(1 + g_1)(1 + g_2) \dots (1 + g_n) R}{(1 + r)^n}$$

where g_1 , g_2 , and so on to g_n are the predicted growth rates in earnings for the first, second, up to nth years, and R is the price/earnings ratio forecasted for the nth year.

The program RETURN can be useful in determining past rates of return experienced on a stock, which can serve as a guide to the discount rate.

VALSTK can be used to calculate intrinsic value, given normalized current earnings per share, growth rates in earnings, dividend payout rates, discount rates, and either a long term growth rate in earnings continuing indefinitely into the future, or a price/earnings ratio forecast for some future point in time. In addition, the program calculates the time period for which a forecasted growth rate must persist, or the price/earnings ratio that must be achieved at a future point in time, in order to make the intrinsic value equal to the current market price.

VALSTK offers some additional flexibility to the formulas given above in forecasting growth rates. The user can forecast growth rates for various time spans in the future and

can also forecast periods of adjustment from one growth rate to another, choosing one of three kinds of adjustment: straight line, which implies that the rate changes by the same amount during each year of the adjustment period; fast, which implies that the adjustment follows a sum-of-the-years digits formula, where the rate changes quickly at the beginning of the adjustment period and slowly at the end; and slow, which implies a reverse sum-of-the-years digits formula, where the rate changes slowly at the beginning of the adjustment period and quickly at the end.

SAMPLE PROBLEM 1

The user requests instructions for supplying data. (Sample Problems 2 and 3 show other ways of responding to the first question.) The answer to item 0 indicates that an intrinsic value is to be calculated. Items 1 through 5 deal with data already referred to. Item 6 asks for a choice between forecasting a long-term growth rate and a future price/earnings ratio, and the user has chosen the former. Hence item 7, the long-term rate, is called for.

Next, the user is asked for item 9, the current year (the year as of which the analysis is being made). The answer to item 9 is 1973.

Finally, growth estimates in earnings per share and estimates of dividend payout ratios and discount rates must be supplied. Each estimate consists of up to eight numbers: the predicted growth rate, the duration of that rate, the dividend payout ratio for that period, the discount rate for that period, the type of adjustment to the next rate, the duration of the adjustment period, the dividend payout ratio for the adjustment period, and the discount rate for the adjustment period. The adjustment period may be zero, implying that there is an immediate shift from one growth rate to another.

In the example, the user has predicted a growth of 25% a year for the 10 years 1974-1983, with a dividend payout of 35% and a discount rate of 20%, followed by a "slow" adjustment over the five years 1984-1988 to a second rate. The second rate is 22%, predicted to last for the five years 1989-1993, with a dividend payout of 40% and a discount rate of 18%, followed by a "slow" adjustment of the two years 1994-1995. Since the user supplied no further forecast, the rates beginning in 1996 will be the long-term growth, dividend payout and discount rates, specified earlier as 5%, 40%, and 16%, respectively. The computer responds with a summary of some of the data supplied and a calculation of the intrinsic value of the stock. The user may have a table of values in future years deduced from the forecasts supplied.

The table shows the forecasted growth rates (the rates in the adjustment periods have been rounded so that the form of the adjustment is obscure), and the earnings-per-share calculated from these rates. The last column shows the intrinsic value year-by-year, and the next-to-last column shows the ratio of intrinsic value to earnings (analogous to a price/earnings ratio).

Next, the user is offered an opportunity to change any of items 0 to 9 and to supply a new set of growth forecasts. A modified set of forecasts gives a different intrinsic value in the problem.

SAMPLE RUN 1

SYSTEM ?BASIC
 OLD OR NEW-OLD VALSTK
 READY
 *RUN

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?YES
 ENTER THE INFORMATION AS CALLED FOR

DO YOU WANT TO DETERMINE INTRINSIC VALUE (ANSWER '1') OR THE
 REQUIRED DURATION OF A SPECIFIC GROWTH RATE (ANSWER '2'), OR
 THE REQUIRED FUTURE PRICE/EARNINGS RATIO (ANSWER '3')

	ITEM 0	<u>?1</u>
CURRENT MARKET PRICE IN \$	ITEM 1	<u>?302</u>
CURRENT EARNINGS PER SHARE IN \$	ITEM 2	<u>?6.85</u>
NORMALIZED EARNINGS THIS PERIOD IN \$	ITEM 3	<u>?7.00</u>
LONG TERM DISCOUNT RATE (AS A DEC.)	ITEM 4	<u>?0.16</u>
LONG TERM DIVIDEND PAYOUT RATIO (AS A DECIMAL)	ITEM 5	<u>?0.4</u>

DO YOU WANT TO FORECAST A LONG TERM GROWTH RATE (1), OR A
 PRICE/EARNINGS RATIO AT A FUTURE POINT IN TIME (2)

	ITEM 6	<u>?1</u>
LONG TERM GROWTH RATE (AS A DECIMAL)	ITEM 7	<u>?0.05</u>
ITEM 8, P/E RATIO AT FUTURE, IS NOT NEEDED FOR THIS CASE.		

CURRENT YEAR (E.G. 1969)	ITEM 9	<u>?1973</u>
--------------------------	--------	--------------

YOU WILL NOW BE ASKED TO FORECAST A GROWTH RATE
 IN EARNINGS, THE DURATION OF THAT RATE IN YEARS, THE
 DIVIDEND PAYOUT RATIO FOR THESE YEARS, DISCOUNT RATE FOR THE
 YEARS, THE TYPE OF ADJUSTMENT FROM THIS TO THE NEXT GROWTH
 RATE (ANSWER '1' FOR STRAIGHT LINE ADJUSTMENT, '2' FOR FAST
 AND '3' FOR SLOW ADJUSTMENT), THE DURATION OF THE ADJUSTMENT
 PERIOD IN YRS., THE DIVIDEND PAYOUT RATIO FOR THE ADJUSTMENT
 PERIOD, AND THE DISCOUNT RATE FOR THE ADJUSTMENT PERIOD.
 THIS WILL BE REPEATED, AND YOU MAY MAKE FORECASTS REACHING
 UP TO SEVENTY FIVE YEARS FROM THE CURRENT YEAR.
 WHEN YOU HAVE PREDICTED ALL THE SPECIFIC GROWTH RATES YOU
 CARE TO, TYPE A 0 AND DO A CARRIAGE RETURN.....

FOR YEARS BEGINNING IN THE YEAR PRINTED OUT BELOW, ENTER THE EARNINGS GROWTH RATE (AS A DECIMAL), THE DURATION OF THE GROWTH RATE IN YEARS, THE DIVIDEND PAYOUT RATIO FOR THESE YEARS, THE DISCOUNT RATE FOR THESE YEARS, THE TYPE OF ADJUSTMENT, THE DURATION OF THE ADJUSTMENT IN YEARS, AND THE DIVIDEND PAYOUT RATIO AND DISCOUNT RATE FOR THIS ADJUSTMENT PERIOD.

1974 ? .25, 10, .35, .2, 3, 5, .35, .2
 1989 ? .22, 5, .4, .18, 3, 2, .4, .18
 1996 ? 0

1973 VALUES

PRICE 302
 EARNINGS 6.85
 P/E RATIO 44.09

LONG TERM GROWTH RATE .05

INTRINSIC VALUE 170.4

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ? YES

YEAR	EARNINGS PER SHARE	GROWTH RATE	VALUE/EARNINGS RATIO	INTR. VAL BEG. OF YR.
1974	8.75	.25	19.47	170.4
1975	10.94	.25	18.2	199.04
1976	13.67	.25	16.98	232.21
1977	17.09	.25	15.83	270.55
1978	21.36	.25	14.73	314.77
1979	26.7	.25	13.69	365.63
1980	33.38	.25	12.7	423.96
1981	41.72	.25	11.76	490.65
1982	52.15	.25	10.86	566.59
1983	65.19	.25	10.01	652.71
1984	81.4	.25	9.21	749.88
1985	101.4	.25	8.47	858.91
1986	125.88	.24	7.79	980.5
1987	155.55	.24	7.17	1115.19
1988	191.1	.23	6.61	1263.32
1989	233.15	.22	6.11	1424.95
1990	284.44	.22	5.58	1588.18
1991	347.02	.22	5.07	1760.28
1992	423.36	.22	4.58	1938.32
1993	516.5	.22	4.1	2117.88
1994	615.49	.19	3.72	2292.49
1995	698.59	.13	3.52	2458.94
1996	733.52	.05	3.57	2622.12

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ? NO

1974 ? .25, 10, .3, .2, 3, 5, .3, .2
 1989 ? .22, 5, .35, .18, 3, 5, .35, .18
 1999 ? .18, 5, .35, .16, 3, 5, .35, .16
 2009 ? 0

INTRINSIC VALUE 360.22

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ? NO

The user now tries a different estimate of the long term discount rate, 15%, and a different estimate of the long term dividend payout ratio, 50%, together with original growth forecasts.

Next, item 0 is changed to call for a calculation of the required duration of a forecasted growth rate in order to make the intrinsic value the same as the current price. First, a single growth rate, 25%, is forecasted to begin in 1974, and the response, that this rate must continue to 1991 to justify the current price, means that the intrinsic value, assuming a growth rate of .25 to 1991 and the long-term growth rate thereafter, is the current market price. Second, a growth forecast through 1988 is supplied, followed by the single growth rate of 22% to begin in 1989. In this case, the 22% rate must continue to 1989 to make the intrinsic value equal the market price.

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?YES
WHICH ITEMS ?4,5
WHAT ARE THE NEW VALUES ?.15,.5

1974	? <u>.25,10,.5,.15,3,5,.5,.15</u>
1989	? <u>.22,5,.5,.15,3,2,.5,.15</u>
1996	? <u>0</u>

1973 VALUES

PRICE	302
EARNINGS	6.85
P/E RATIO	44.09

LONG TERM GROWTH RATE .05

INTRINSIC VALUE 380.43

The user next changes item 0 to call for a calculation of intrinsic value, and item 6 to specify a calculation based on a forecast of a price/earnings ratio rather than a long-term growth rate. The ratio forecast, 30, is entered as a new item 8. The growth forecast extends to 2013 (no adjustment is specified because no succeeding growth rate will be used — the price/earnings ratio will be applied as of 2013). The computer responds with an intrinsic value and the actual forecasted price in 2013, based on the ratio and the earnings growth projections.

A second forecasted price/earnings ratio, 25, is tried along with a different growth forecast; another intrinsic value is calculated, and then the user changes item 0 to call for a calculation of the price/earnings ratio required to make the intrinsic value equal to the current market price.

1973 VALUES

PRICE 302
EARNINGS 6.85
P/E RATIO 44.09

INTRINSIC VALUE 1027.44

FOR YEAR 2013 FORECASTED P/E IS 30 AND PRICE IS 182126.3

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ?NODO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?YESWHICH ITEMS ?8WHAT ARE THE NEW VALUES ?5

1974	? .18, 5, .5, .15, 3, 5, .5, .15
1984	? .15, 10, .5, .15

1973 VALUES

PRICE 302
EARNINGS 6.85
P/E RATIO 44.09

INTRINSIC VALUE 300.4

FOR YEAR 1993 FORECASTED P/E IS 25 AND PRICE IS 3550.71

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ?NODO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?YESWHICH ITEMS ?0WHAT ARE THE NEW VALUES ?3ITEM 6 ?2

1974	? .18, 5, .5, .15, 3, 5, .5, .15
1984	? .15, 5, .5, .15

REQUIRED P/E RATIO IN 1988 TO JUSTIFY PRICE IS 27.68

A table of future values can be obtained by shifting item 0 back to 1, to call for an intrinsic value calculation and by supplying the price/earnings ratio forecast as the number just calculated.

VALSTK-8

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?YES

WHICH ITEMS ?0

WHAT ARE THE NEW VALUES ?1

ITEM 6 ?2

ITEM 8 ?27.68

1974 ?.18,5,.5,.15,3,5,.5,.15

1984 ?.15,5,.5,.15

1973 VALUES

PRICE 302

EARNINGS 6.85

P/E RATIO 44.09

INTRINSIC VALUE 301.96

FOR YEAR 1988 FORECASTED P/E IS 27.68 AND PRICE IS 1954.57

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ?YES

YEAR	EARNINGS PER SHARE	GROWTH RATE	VALUE/EARNINGS RATIO	INTR. VAL BEG. OF YR.
1974	8.26	.18	36.56	301.96
1975	9.75	.18	35.2	343.13
1976	11.5	.18	33.89	389.73
1977	13.57	.18	32.6	442.43
1978	16.01	.18	31.35	502.01
1979	18.87	.18	30.16	569.31
1980	22.19	.18	29.08	645.27
1981	25.99	.17	28.12	730.96
1982	30.3	.17	27.31	827.61
1983	35.11	.16	26.68	936.6
1984	40.37	.15	26.24	1059.54
1985	46.43	.15	25.81	1198.28
1986	53.39	.15	25.37	1354.81
1987	61.4	.15	24.94	1531.33
1988	70.61	.15	24.5	1730.33

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?END

SAMPLE RUN 2

Rapid input of data is shown below where the answer to the initial question is NO.

SYSTEM ?BASIC
OLD OR NEW-OLD VALSTK

*RUN

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?NO
ENTER ITEMS 0 THROUGH 6 AND ITEM 9 ?1,302,6.85,7,.16,.4,1,1973
ITEM 7 ?.05

1974	? <u>.25,10,.35,.16,3,5,.35,.16</u>
1989	? <u>.22,5,.4,.16,3,2,.4,.16</u>
1996	? <u>0</u>

1973 VALUES

PRICE	302
EARNINGS	6.85
P/E RATIO	44.09

LONG TERM GROWTH RATE .05

INTRINSIC VALUE 241.34

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ?NO

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?END

VALSTK-10

SAMPLE RUN 3

Sample Run 3 shows DATA lines as alternative input. The data listed is presently in the program. The user's own data can be entered to overlay it.

SYSTEM ?BASIC
OLD OR NEW-OLD VALSTK
READY
*LIST 3910-3930

3910 DATA 1
3920 DATA 302,6.85,7,.16,.4
3930 DATA 1,.05,30,1973

READY

*RUN

DO YOU WANT INSTRUCTIONS FOR SUPPLYING DATA ?DATA

1974 ?.25,10,.4,.16,3,5,.4,.16
1989 ?.22,5,.4,.16,3,2,.4,.16
1996 ?0

1973 VALUES

PRICE 302
EARNINGS 6.85
P/E RATIO 44.09

LONG TERM GROWTH RATE .05

INTRINSIC VALUE 251.31

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ?NO

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?NO

1974 ?END

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS ?NO

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?YES

WHICH ITEMS ?Q

WHAT ARE THE NEW VALUES ?2

ITEM 6 ?1
ITEM 7 ?.05

1974 ?.25

GROWTH RATE .25 MUST LAST TO 1991 TO JUSTIFY PRICE

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?NO

1974 ?.25,10,.5,.15,3,5,.5,.15
1989 ?.22

GROWTH RATE .22 MUST LAST TO 1992 TO JUSTIFY PRICE

DO YOU WANT TO CHANGE ANY OF ITEMS 0 TO 9 ?YES

WHICH ITEMS ?0,6

WHAT ARE THE NEW VALUES ?1,2

ITEM 8 ?30

1974 ?.22,10,.5,.15,3,5,.5,.15
1989 ?.18,10,.5,.15,3,5,.5,.15
2004 ?.15,10,.5,.15

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